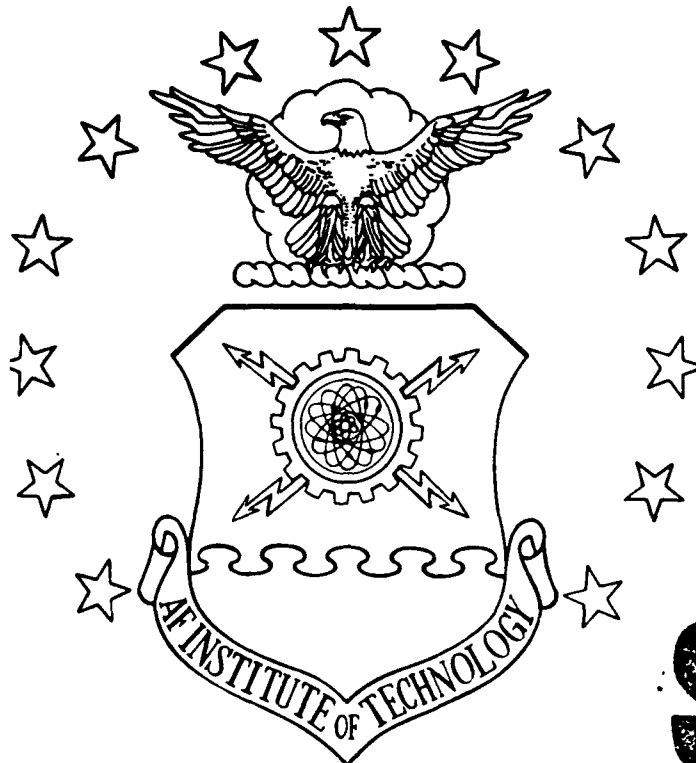AD-A246 686

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EVALUATION OF CORRECTIVE ACTION
TEAM (CAT) LEADER TRAINING IN
AERONAUTICAL SYSTEMS DIVISION

THESIS

Kirk J. Streitmater, Captain, USAF

AFIT/GSM/LSR/91S-25

DEPARTMENT OF THE AIR FORCE

AIR UNIVERSITY

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92-04902

Wright-Patterson Air Force Base, Ohio

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AFIT/GSM/LSR/91S-25

EVALUATION OF CORRECTIVE ACTION TEAM (CAT) LEADER TRAINING

IN AERONAUTICAL SYSTEMS DIVISION

THESIS

Presented to the Faculty of the School of Systems and

Logistics of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the

Requirements for the Degree of

Master of Science in Systems Management

Kirk J. Streitmater, B.S.

Captain, USAF

September 1991

Approved for public release; distribution unlimited

Preface

The purpose of this study was to evaluate corrective
action team (CAT) leader training, a group problem solving
and team dynamics course offered as part of the growing
quality initiatives at Aeronautical Systems Division (ASD).
I chose the subject because I believe in the idea of
providing the worker with tools that improve their
effectiveness both in and out of the work environment.
Since I was planning on spending the next ten months of my
life on a research project, I thought it important to find a
relevant subject where I could make an immediate
contribution. Evaluating CAT leader training met my
requirements.

In the course of the research I was involved in several
different training classes and reviewed the responses of
over 200 course graduates. I found each class to be a
unique group of professionals consisting of employees with
an honest desire to improve themselves and the organization.
An impressive fifty-seven percent of the graduates surveyed
took time from their schedules to respond to the
questionnaire showing a true desire to improve the training
provided by the Total Quality office. Many graduates
provided excellent comments regarding the training.

This thesis was a team effort and would not have been
possible without the help of many. I would like to thank
the ASD Total Quality Office for all their support, time,

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AFIT/GSM/LSR/91S-25

Abstract

This study evaluated corrective action team (CAT)
leader training, a team dynamics and group problem solving
course provided by an Air Force product division. A
pre/post knowledge test, using developed behavioral
objectives, was administered to 61 participants as part of
an internal evaluation while 373 past participants were
provided a questionnaire for a field evaluation.

Results from the internal evaluation indicated that
students learned the majority of training material presented
in the course. Self-efficacy increased in most cases
showing an improved self-perception regarding the ability to
perform training related tasks. Predictors for a pre-test
score model were identified, but overall provided limited
explanatory power to predict a student's pre-score.

The field evaluation showed that the majority of
graduates, 152 out of 208 (73%), do not function as CAT
leaders. Those who do lead CATs, are assigned an issue
within three months of training and consider the issues
worked relevant to a group problem solving approach. Half
of the ten tools and techniques taught in training were used
by the majority of graduates, while the other half saw
little use. All are perceived as having at least some
degree of usefulness by the majority of respondents.

EVALUATION OF CORRECTIVE ACTION TEAM (CAT) LEADER TRAINING IN AERONAUTICAL SYSTEMS DIVISION

I.   Introduction

General Issue

Aeronautical Systems Division (ASD) leadership has embraced the concept of Total Quality Management (TQM) for the organization (Roth, et al., 1990:iii,2). The corrective action team (CAT) is one initiative that encourages employee involvement in TQM. CATs are formed on an as needed basis to look into improvement opportunities in the work environment (ASD/TQ, undated:3). As problems are identified in an organization, management can use ᴀ pool of trained CAT leaders to facilitate problem resolution by collecting and working with a team of people involved in the process.

Training for CATs is provided to the CAT leader and involves a four day off-site seminar program in group problem solving and team dynamics (ASD/TQ, undated:3). This training program and the associated resources for the four day seminar represent a serious commitment from management to provide employees of ASD with the tools to effectively solve problems at their level.

Currently, over 1,600 people or 15% of the ASD population is involved in some form of quality related team (Roth, et al.,1990:11). ASD's ultimate goal is increasing

the "empowerment, involvement, effectiveness, and productivity of all employees." (Roth, et al., 1990:12) CAT leader training is recognized as one of the methods to accomplish this.

To work toward that end, this study was proposed and accomplished to identify the effectiveness of the current CAT leader course, and propose improvements for the future. As with any training program, the key to effective implementation is a continual evaluation of the product to ensure it is accomplishing its objective (Gagne and Briggs, 1979:36-38).

Specific Problem

Nineteen ASD CAT Leader training sessions have been held involving over 440 participants. To date, there has been no formal review of the program. This deficiency was noted in a recent evaluation of their Total Quality program by the Federal Quality Institute when ASD competed for the Quality Improvement Prototype (QIP) Award. The report identified "little evidence of evaluations done on effectiveness of training programs" (Franke, 1990). In addition to this report, Lieutenant General Thomas R. Ferguson, the Commander of ASD, has placed a strong emphasis on the development of metrics both in the area of quality initiative results and the organizational effects of quality training and programs (Roth et al., 1990:5).

Both the need for training evaluation and the development of quality related metrics are addressed by this study. It provides a beginning for a comprehensive evaluation of the training program that includes both an internal and field evaluation. In addition, it provides a set of measurements that identify the current status of CAT training and implementation and lays the groundwork for future longitudinal studies on those same areas. The specific objectives that describe the research accomplished are identified below.

Research Objectives

This research had six major objectives designed to improve the quality and effectiveness of the CAT leader training program. These six objectives were:

1. Identify and document the specific material provided as part of the current course curriculum.

2. Determine if the CAT leader training course facilitates learning of the course material and improves a trainee's self-efficacy regarding application of course material

3. Determine the characteristics of current corrective action teams and the involvement of graduates.

4. Identify the level of self-efficacy of past attendees regarding application of course material.

5. Identify how past attendees perceive and apply the problem solving tools and techniques provided in the course.

6. Based on the above objectives, provide the Commander of ASD with recommendations for improvements to the current CAT leader training curriculum.

These objectives provide a guideline for the research and determine the scope of the work proposed. To further

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define research requirements and reach the above objectives,
more specific research questions are proposed.

Investigative Research Questions

The investigative research questions provided the
specific guidelines for the research and represented a more
detailed breakdown of the research objectives identified
above. Each is individually addressed in the presentation
and discussion of results chapter of the paper. The
investigative questions include:

1. Is the basic curriculum described by the
information in the CAT leader notebook taught by all
course facilitators?

2. Does CAT leader training improve the knowledge of
participants in each of the training blocks presented?

3. Are the following antecedent variables significant
predictors of a student's performance in the knowledge
pre-test (Y)?

  X1. Involvement in previous CATs (Experience)
  X2. Previous problem solving/team dynamics
      training (Training)
  X3. Education Level (Education)

4. Is there an overall increase in self-efficacy in
the application of course material as a result of
attending CAT leader training?

5. Are a significant number of CAT leaders assigned
CAT issues within three month of training?

6. Are there a significant number of training
participants becoming members of CATs?

7. Is there a noticeable decline in self-efficacy
regarding application of training material as time
since training increases?

8. Are problem solving tools and techniques being used
in the organizational and CAT environments?

9. Are problem solving tools and techniques perceived as being used frequently in the CAT and organizational environment?

10. Are problem solving tools and techniques perceived as being useful tools for team problem solving?

11. Do a significant number of CAT leaders rate the use of a CAT as appropriate in addressing the CAT-related issues assigned?

Scope

This study was limited to evaluating CAT leader training in Aeronautical Systems Division. Conclusions drawn cannot be applied to other organizations. Review of the current training program was specifically emphasized in the research with sources of information that included the CAT leader notebook (ASD/TQ, undated), the course syllabus, past course evaluation forms, and discussions with instructors.

Research consisted of three parts: development of objectives, a pre/post knowledge test administered during the course and a field questionnaire for past participants. The purpose of developing course objectives was primarily to formalize the current desired behavioral outcomes of the training rather than to evaluate the syllabus currently in place. This resulted in observations regarding material in the course curriculum, but did not involve discussing what *should be* in a course for CAT leaders.

Knowledge testing accomplished during the training as part of this project focused primarily on the knowledge and comprehension levels of learning in the cognitive domain

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(Bloom, et al., 1971). Research into higher levels of learning such as analysis, synthesis and evaluation is reserved for follow-on projects.

The field questionnaire solicited feedback on the use of CAT leader course material and the current conditions and procedures of CATs in ASD. Of major interest was the applicability and use of the problem solving tools and techniques currently part of the course curriculum. The majority of the participants were from Aeronautical Systems Division with other participants representing Air Force Systems Command, Air Force Logistics Command, and Defense Electronic Systems Center. While over 400 individuals have received CAT leader training, the field research only dealt with those 373 Air Force personnel who report to the commander of ASD, whose organization sponsors the training. This simplified the research, since coordination with other Air Force organizations was not required to gather data.

Summary

This research was only the first step in evaluating CAT leader training and hopefully provides a basis for more in-depth study to improve the course curriculum and ultimately its effect on the organization.

The following chapter provides background to TQ and CAT leader training in Aeronautical Systems Division. Chapter 3 provides a literature review associated with learning theories and training program evaluation. Chapter 4

describes the research methodology used. Chapter 5 then discusses the results of the evaluation that lead to conclusions and recommendations provided in Chapter 6.

II. Background

Introduction

This chapter provides the background of CAT leader training. While the training is applicable to many organizational situations, its primary emphasis has been for use in the organizational total quality structure. A brief discussion of that structure follows, along with information on the development, format, and content of the course itself.

Total Quality in Aeronautical Systems Division

Aeronautical Systems Division (ASD) leadership has embraced the concept of Total Quality Management (TQM) for the organization (Roth, et al., 1990:iii,2). The ASD definition of Total Quality Management was identified in an executive off-site in 1988 as:

> A leadership philosophy that creates a working environment which promotes trust, teamwork, and the quest for continual improvement. (Roth, et al., 1990:1)

As a result of this definition and the vision that ASD would strive to remain "the center of excellence for research, development and acquisition of aerospace systems," (Roth, 1990:1) ASD developed a set of TQ principles to describe how it will operate to encourage a TQ environment (Roth, et al., 1990:2). These principles include:

1. Know and satisfy the customers' needs.

2. Delegate responsibility and authority - accept accountability.

3. Give EVERYONE a stake in the outcome.

4. Set goals, compete, measure progress, and reward.

5. Create a climate of pride, professionalism, excellence, and trust.

6. Strive for continuous improvement - Make It Better! (Ridgely, undated:6)

To facilitate incorporating these principles into the ASD organizational culture a TQ structure was created in each reporting organization. Over the next two years, ASD senior leadership focused their efforts on several key issues to improve the quality culture. These included emphasis on the following areas: quality environment, quality measurement, quality improvement planning, employee involvement, employee training and recognition, quality assurance, and customer focus (Roth, et al., 1990:1-17). Progress in the Total Quality program in ASD prompted management to submit an application and be selected as one of ten finalists for the 1991 Quality Improvement Prototype (QIP) Award (Franke, 1990). The structure for the TQ organization established is described below.

Organizational TQ Structure

Within each reporting organization in ASD, a TQ structure has been developed to facilitate the incorporation of the quality principles discussed above into the organizational culture (Ridgely, undated:12). These organizations mainly consist of system program offices (SPOs) that manage a particular weapon system, functional

deputies that provide matrix support to SPOs, research and development laboratories and a flight test wing. Each organization has the same general total quality management structure as shown in Figure 1 and defined below:
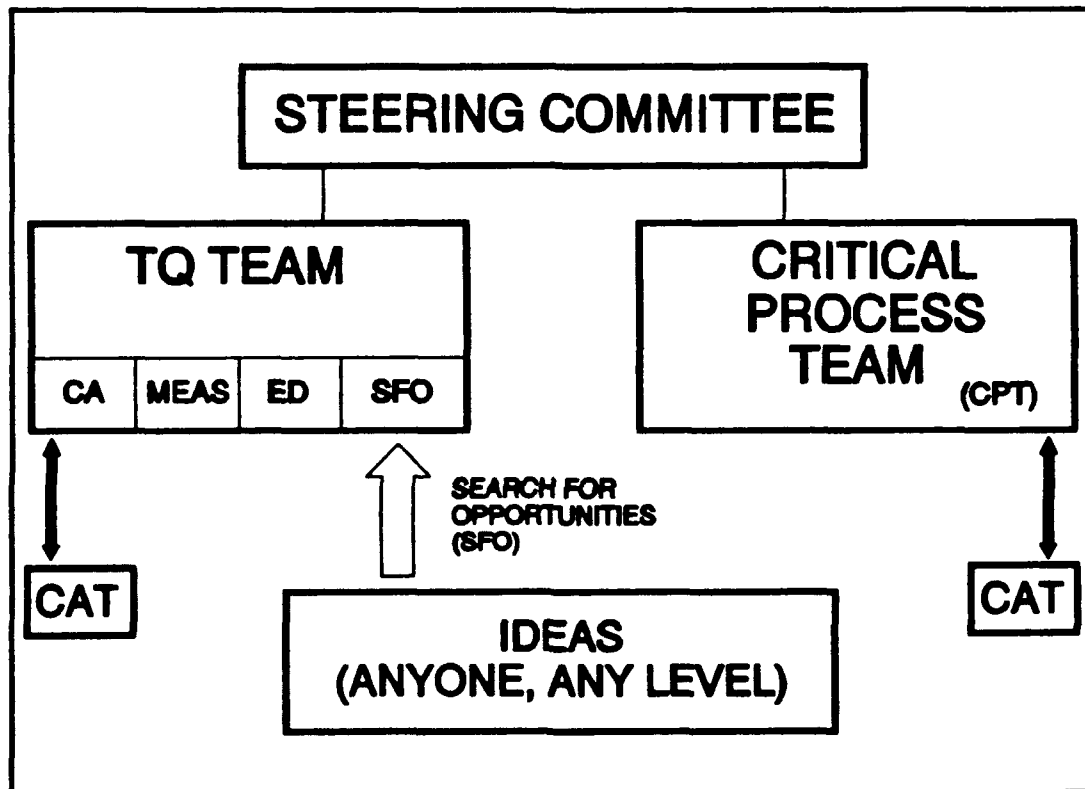
Figure 1. Generic TQ Structure in ASD (Roth, et al., 1990:3; Ridgely, undated:12)

The Executive Steering Committee (ESC). The Executive Steering Committee (ESC) consists primarily of the organization's main leaders and develops the policy and strategic plans regarding TQ. It establishes the organization's vision, goals, and objectives and oversees TQ by providing resources and demonstrating management commitment (Roth, et al., 1990:4).

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The TQ Team. The TQ Team is seen as the primary
instrument in the TQ structure. It is made up of a cross
section of organizational personnel and is responsible for
designing, implementing and managing a system to facilitate
solving organizational problems (Ridgely, undated:12). To
accomplish this, four subsystems are normally implemented.
These include the Education subcommittee to energize and
educate the organization on Total Quality, the Search for
Opportunities (SFO) subcommittee that focuses on generating
employee-related ideas, the Corrective Action subcommittee
that uses corrective action teams to solve problems
identified by employees, and the Measurement subcommittee
that measures progress in solutions and key objectives
(Roth, et al., 1990:4).

The Corrective Action Team (CAT). In problem
resolution, the corrective action team (CAT) is commissioned
by the Corrective Action subcommittee or Executive Steering
Committee to work specific problems. The team is comprised
of individuals inside the organization who are knowledgeable
about aspects related to the problem. The CAT is led by a
CAT leader who has received specific training in group
problem solving techniques and team dynamics via CAT leader
training. Other team members receive no training, but look
towards the CAT leader to teach the methodology needed to
facilitate team effectiveness. The CAT is formed to address
a specific problem, and after problem resolution, is
disbanded. Once the CAT is dissolved, the CAT leader is

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then available for reassignment to another issue (ASD/TQ, undated:3).

The Critical Process Team (CPT). The final team involved in the TQ structure is the critical process team (CPT), which is chartered by the ESC to investigate "high level, cross-organizational processes which have a critical impact on satisfying the customer's requirement." (Roth, et al., 1990:4) These teams are similar to CATs, except the issues addressed are more complex and the entire team receives problem solving training together (Ridgely, undated:14).

Search For Opportunity (SFO). The Search For Opportunity (SFO) is a method of encouraging participation by soliciting employee ideas and improvements through the formal TQ structure. The employee inputs are normally submitted on a form designed specifically by the organization and placed in accessible locations throughout the work area. A completed form receives prompt attention and is formally tracked to ensure a submitter's concerns, ideas or suggestions receive adequate consideration. SFOs fall into one of three types. These "types" of SFOs aid in tracking and assigning issues to the appropriate owners and organizations. The three types of SFOs include:

Type 1: The issue falls within the control of a single office that has the power to make changes, if appropriate.

Type 2: The issue may involve coordination by several offices in an organization and normally is a prime candidate for a corrective action team (CAT).

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Type 3:   The issue is beyond the scope of
influence for an organization and is sent up to the ASD
level (or higher) to be addressed.   These SFOs are
formally tracked by ASD/TQ.   (ASD/TQ, undated:10)

The SFO is the basis of employee involvement in the TQ
culture and is the first form of documentation that defines
an issue.   They often provide the rationale used to
establish a CAT or CPT.   Unlike a suggestion system,
solutions are not a requirement when the SFO is submitted
(Roth, et al, 1990).

Now that the TQ structure has been discussed, further
detail on the specifics of CAT leader training are provided.

CAT Leader Training

Currently, training is accomplished monthly in a 4-day
off-site seminar format that begins Tuesday morning and ends
Friday afternoon.   The overall objective involves developing
CAT leaders who can successfully "lead a CAT through the
problem solving process to implementation of a solution to
an organizational issue." (ASD/TQ, undated:Tab)   Specific
course objectives currently include training a CAT leader:

1.   To be able to organize a corrective action team and
manage the group dynamics so that the CAT develops into
and remains and effective, functioning team.

2.   To be able to explain the TQ structure and
philosophy to individual members and how the CAT fits
into the overall TQ process.

3.   To be able to teach the problem solving methodology
and the appropriate tools and techniques to CAT members
so that they are able to effectively use them in the
problem solving process. (ASD/TQ, undated:Tab)

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As noted by the above three objectives, CAT leader training focuses on three key issues: group or team dynamics, the TQ structure and philosophy, and the problem solving process.

Background and Transition to Internal Training. The majority of ASD's transition to a TQ-focused culture was facilitated by the Cumberland Group, a former subsidiary of AARMCO Steel that formed their own TQ consulting company. Initially Cumberland accomplished all TQ-related training for ASD through a support contract (ASD/TQ, undated:1). Early on, a plan to transition the education and training responsibility from Cumberland to ASD was developed to establish an eventual ASD self-contained training program that encouraged a TQM culture working for constant improvement.

CAT leader training was the first training program scheduled to be completely supported by ASD personnel, which included a group of specially trained facilitators for the program.

Course Facilitators. With the plan to transition the CAT leader training responsibilities in 1989 from Cumberland to ASD, an organization-wide request for facilitator volunteers was conducted. Those individuals interested in becoming a facilitator required the approval of their management to submit an application. Twelve part-time CAT leader course facilitators were chosen in ASD and in July of

1989 attended a 1 week off-site dry run for the pilot program (Ball, 1991).

On September 1 of 1989, the first ASD sponsored CAT leader training was conducted. The exclusive use of part-time facilitators was continued until April of 1990 when full-time coordinators were added to the ASD Commander's Office for Total Quality (ASD/TQ) staff (Ball, 1991). In addition to working with part-time facilitators on CAT leader training, these full-time facilitators also conducted other TQ related training, served as a facilitator resource for individual ASD organizations, and supported various management functions on quality at the ASD level.

As of February 1991, five of the 12 original part-time facilitators were still involved in CAT leader training. Two have become full-time facilitators for ASD and continue with their involvement in the training.

New facilitators are introduced to the training by attending the CAT leader course as a student and then at least once as an observer. Once the new facilitator feels thoroughly comfortable with the material and the presentations, he/she may start leading course discussions. The materials provided to facilitators for class preparation include: an instructor's notebook (developed by the Cumberland Group), a CAT leader course notebook provided to all participants, and various material associated with training exercises. Additional support for new personnel is provided by current course instructors and a Cumberland

Group facilitator training course that is included in its current support contract with ASD (Wissman, 1991).

Course Administration. A CAT leader training course is normally scheduled several months in advance by the ASD Commander's Office for Total Quality and follows the format provided by the syllabus in Appendix A. Each course averages approximately 19 attendees and is facilitated by two to three instructors with course experience. Normally two facilitators are assigned to each course, but others may be added to account for previous scheduling conflicts, new instructors, or group size.

The facilitator team meets prior to the course and agrees on team norms which define roles, responsibilities and procedures for the course. Team norms often include allocation of facilitator duties and briefing responsibilities, selection of specific problem exercise examples to reinforce course topics and determining meeting times to discuss possible schedule changes.

A syllabus defines the course material, but facilitator teams have a large amount of flexibility to tailor the training material for each course offering. Several team exercises are available for use during the training to emphasize important topics and provide hands-on reinforcement of training concepts.

Course Content. The course runs for four consecutive days and covers six different training blocks that are identified in Figure 2. They include an overview of TQM,

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effects of personal values, group dynamics, the problem
solving process, problem solving tools and techniques and
meeting effectiveness. This curriculum is designed to
accomplish the 3 terminal objectives identified at the
beginning of this section.

```
1.  Overview of Total Quality Management (TQM)
2.  Effects of Personal Values
3.  Group Dynamics
4.  The Problem Solving Process
5.  Problem Solving Tools and Techniques
6.  Meeting Effectiveness
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Figure 2. CAT Leader Training Blocks (ASD/TQ, undated)

Exercises and videos are also an important part of the
curriculum and are used after many presentations to
reinforce the topics discussed. Often the exercises involve
small teams of participants getting together to practice
techniques by working a realistic problem scenario.

The last day of the course involves a large exercise
where three to four teams are provided a problem that
involves reduced attendance to the base cafeteria. Each
group is encouraged to use the material learned during the
week to make recommendations to management. Facilitators
take on several roles during the exercise to provide
information to the teams and then represent management
during the out brief. Feedback is provided to all groups

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with the use of material being emphasized rather than the final conclusions.

   Current Status. CAT leader training has now been taught by an ASD cadre to over 440 personnel in 23 different course offerings. As of 1990, more than 160 quality related teams including CATs, CPTs, and TQ Teams have been functioning in ASD (Roth, et al., 1990:11). To date, there has been no formal evaluation of the course to assess its effectiveness in ASD. As noted earlier, ASD was selected as one of ten finalists for the 1991 Quality Improvement Prototype (QIP) Award. One area of needed improvement noted by the Federal Quality Institute, who judged the QIP competition, regarded the evaluation of training effectiveness. As a result of this finding, and Lieutenant General Ferguson's desire to identify metrics for evaluating TQ effectiveness in ASD, the Commander's Office for Total Quality agreed to sponsor this research. This research, along with the course evaluations that have been utilized throughout the training program should provide an avenue for assessing training effectiveness and improving the current course.

Summary

   ASD Total Quality structure and CAT leader training specifics were discussed to familiarize the reader with the research topic. Discussion of the current status of the CAT leader course identified the level of training accomplished

to date and provided a background and rationale for this effort. Chapter 3 follows with a background discussion on learning and evaluating training programs.

III. Literature Review

Introduction

The literature on learning, behavior, instructional theory and training evaluation is extensive and cannot possibly be covered in this brief review. However, relevant highlights to key theories will provide a background and summary of important concepts of the research that dictated the approach taken in the effort.

Theories of learning and how learning is evaluated and applied will provide a basis for the discussion of the instructional system design and the systems approach to training. Training evaluation will be specifically emphasized because of the research focus as will the use of research design in course evaluation.

General Theories of Learning

The desired learning outcome is often to invoke a relatively permanent change in behavior that results from experience (Daft and Steers, 1986:48). While the behavior change is a central issue, both the behavioral and cognitive aspects of learning provide for a more complete definition and theory foundation (AFM 50:62, 1984:2-1; Luthans, 1979:100-101). Luthans identifies an expanded concept of learning as follows:

1.   Learning involves a change, though not necessarily an improvement, in behavior.

2.   The change in behavior must be relatively permanent in order to be considered learning.

3. Some form of practice or experience is necessary for learning to occur.

4. Finally it should be stressed that the practice or experience must be reinforced in some way in order for learning to occur. (Luthans, 1977:281)

Daft and Steers provide a brief review of the three theories identified as fundamental to learning and related to the four points identified above. These are: 1) classical conditioning; 2) operant conditioning; and 3) cognitive learning theory. Both classical and operant conditioning focus on a stimulus response condition in the learning process (Daft and Steers, 1987:49) which places a significant emphasis on the manipulation of the environment to promote learning. Cognitive theory focuses not on environment, but on how a learner "remembers and retrieves information from memory." (Richey, 1986:65) The three theories are summarized below.

Classical Conditioning Theory. Classical conditioning theory originates from the Russian physiologist Pavlov's experiments with dogs. In Pavlov's famous experiments, dogs were taught to salivate at the sound of a bell. In this case, a link between a conditioned stimulus (a bell) and an unconditioned stimulus (meat) was reinforced by introducing both stimuli simultaneously. Since a dog's natural response is to salivate at the sight of meat it represented no learned behavior; however, repeated linking of the bell and meat resulted in the dog salivating at the sound of the bell even when the meat was absent. In this case, Pavlov

concluded that learning had occurred because the dog now associated two normally unrelated objects (Daft and Steers, 1986:50).

Operant Conditioning Theory. Skinner in his article Operant Behavior (1963) introduces the concept of rewards into the realm of learning by noting that an organism is behaving a given way because it expects a given effect (503). His position is an extension of Thorndike's "law of effect" which introduced the principle that the effect of action itself causes future action to occur (Skinner, 1963:503). This "law" argues that behavior resulting in positive reinforcement will likely be repeated, and behavior with negative consequences will be avoided (Daft and Steers, 1986:51). In effect, learning occurs as a consequence of behavior (Luthans, 1977:284). Daft and Steers identify three important concepts of this model that must be present for it to apply:

1. *Drive*: A felt need exists and must be present before learning can take place.

2. *Habit*: The ability to develop an experienced bond or connection between stimulus and response.

3. *Reinforcement or reward*: The feedback or consequence individuals receive as a result of action.
(Daft and Steers, 1986:51)

The drive and habit concepts are both considered part of the stimulus-response bond and the stronger each is, the stronger the motivation of the individual to respond in a certain way. Both classical and operant conditioning are considered behaviorist theories and are important in that

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manipulating the environment is a key aspect of promoting learning (Fogg, 1990:19).

Cognitive Theory. Cognitive learning theorists contend that much learning does not involve the stimulus-response bond but is the result of acquisition, analysis and insight of known facts (that can include abstract concepts and generalizations) that allow more sophisticated learning to occur in the proper environment (Daft and Steers, 1986:52). Concepts such as expectancy, demand, and incentive are utilized as the cognitive model emphasizes the positive and free will aspects of humans (Luthans, 1977:100).

Luthan's statement itself identifies the contrast in the theories. While much of the research that deals with behavioral principles involves some use of animal research, cognitive theory has focused primarily on human subjects (Richey, 1986:65).

While the initial acceptance of cognitive theory was limited, it has recently received more attention. Richey (1986) identifies one major example by noting the increased attention given to instructional design. She also references the work of Gagne and White (1978) in identifying the role of cognitive theory as a key element of instruction leading to learning and a change in performance (66).

Evaluation of Learning

Although learning is not a directly observable phenomena (Daft and Steers, 1986:49), criterion standards

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that allow you to measure the amount of learning that has occurred are necessary. The Taxonomy of Educational Objectives is a classification system of educational objectives that was developed to facilitate communication among researchers and others regarding objectives, test items, and test procedures (Bloom, et al., 1971:39).

The three specific taxonomies include cognitive, affective and psychomotor. Of specific importance in this research are the taxonomies regarding the cognitive and affective domains identified in Figures 3 and 4.

Cognitive Domain	
Level of Learning	Mental Activity
Evaluation	Exercise of Learned Judgement
Synthesis	Create new relationships
Analysis	Determine relationships
Application	Use of generalizations
Comprehension	Translate, interpret, extrapolate

Figure 3. Bloom's Taxonomy of Educational Objectives
(AFM 50-62, 1984:2)

The cognitive domain taxonomy was initially proposed by Bloom (1956) and involves intellectual responses of the learner and the level of mental activity regarding the learned material. The affective domain (Krathwohl, et al., 1964) involves more the internalization or level of acceptance of the learned material (Bloom et al., 1979:39; Knirk and Gustafson, 1986:80-81). The taxonomy levels

provide a hierarchical framework to the process where
behaviors progressively get more complex, abstract and
internalized (Bloom, et al., 1971:39).

Affective Domain	
Level of Learning	**State of Mind**
Characterization	Incorporates values into life style
Organization	Rearrangement of value sys...
Valuing	Acceptance
Responding	Reacts voluntarily or complies
Receiving	Willingness to pay attention

Figure 4.   Krathwohl's Taxonomy of Educational
Objectives (AFM 50-62, 1984:2)

The use of these taxonomies allows a more universal
means of measuring behavioral outcomes and determine the
appropriate level of instruction for students (Knirk and
Gustafson, 1986:82). This fact seems critical in
considering the level and type of instruction students
should receive and how to measure the impacts of that
instruction.

Ultimately, the taxonomies provide a useful tool both
to translate broadly stated objectives into operational
terms and build items to measure "higher order mental
processes or affective outcomes of instruction." (Bloom, et
al., 1971:40)

Application of Learning

Even though the cognitive theory focuses on the internal processing that results in learning, both recognize the effects of learning on the environment. As a matter of fact, Skinner poses that the reason we are interested in behavior at all is because of those effects on the environment (Skinner, 1963:503). So, it is not exclusively the environment in which the learning occurs that matters, it is the environmental impact of the learned behavior. Thorndike's discussion of transferability from Crooks assessment of classroom evaluation practices (1988) states the point well:

> The crucial indicator of a student's understanding of a concept, a principle, or a procedure is that he is able to apply it in circumstances that are different from those under which it was taught. Transferability is the key feature of meaningful learning. So if we are to test for understanding, we must test in circumstances which are at least part new. (Crooks, 1988:442-443)

Crooks points out above that a student's learning needs to be tied with the ability to transfer what is taught into a new environment. Several factors are important to the amount of transference that occurs and relate to the amount of learning made by the student. Three such factors are retention, self-efficacy, and attitudes.

Retention. Retention is seen as a principal effect of learning and is an important determinant of the amount of transfer that will eventually occur in a job situation (Goldstein, 1986:80). Goldstein identifies several effects

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on the retention process that can effect transference in the area of personnel training:

> 1. *The degree of original learning.* Any effect that limits original learning will affect retention. These include whole vs part learning, massed vs spaced practice, overlearning, and knowledge of results.
>
> 2. *Meaningfulness of the material.* The more meaningful the material, the more it is retained
>
> 3. *The amount of interference.* Both material learned before (proactive) and after (retroactive) can interfere with the recall of original material.
>
> 4. *Motives, perceptions, and retention.* Memory is often affected by our perceptions of events and the state of mind during the original occurrence.
> (Goldstein, 1984:87-88)

Self-Efficacy. Bandura identifies self efficacy as a students' perception of his/her capability to perform courses of action with respect to a certain situation (Bandura, 1982:122). Crooks (1988) notes that perceptions of self-efficacy in an area have a high correlation with ultimate success in that area. Even with difficult tasks or encounters with failure, a higher self-efficacy often results in a stronger effort and a higher level of task success (Crooks, 1988:462).

Attitudes. The two classes of attitudes that relate to learning involve attitudes that relate to how readily an individual learns and attitudes that are a established or changed as a result of learning (Gagne and Briggs, 1979:84-85). Since the philosophy of TQM involves a change in the organizational culture (Roth, et al., 1990:1), attitudes play an important part in TQM success. This is highlighted

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by Gagne and Briggs' (1979) identification that values function to affect "approaching" or "avoiding" specific behaviors (85). One important result of this condition is that specific behavioral outcomes result from changes in attitudes.

The Learning Theory and Training Gap

The application of learning theory developed over the past decades would seem to support an efficient and effective transition to the modern training and instructional environment, but Goldstein (1984) along with others have found that the significant progress made in learning theory has focused in the laboratory environment making application difficult and slow (Goldstein, 1984:64). Three reasons specifically identified include:

> 1. The learning theorists have tended to focus on highly specific laboratory experimentation, which has made generalizations to field settings extremely difficult.
>
> 2. Until recently, the learning theorist has ignored the complex areas of human behavior. Thus there is relatively little information available on problem solving, perceptual motor learning, concept learning, and other topics directly relevant to the needs of the training specialist.
>
> 3. The training specialist often demands quick answers and ready solutions to complicated problems (McGehee and Thayer, 1961). When easy solutions are not immediately apparent, the practitioner often assumes that the learning theorist's entire program is irrelevant... [and]...ignores learning theory and contributes little information of his own. (Goldstein, 1984:64)

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To deal with the transition from learning theory to training application the Instructional System Design was developed and is described below.

Instructional System Design Theory

In the realm of an instructional setting, objectives that define the level of learning desired are required to establish methods of measuring that learning. In discussing the learning environment, Goldstein (1984) referenced Gagne's paper *Military Training and Principles of Learning* (1962) noting that developed learning principles were "strikingly inadequate to handle the job of designing effective training situations" (p. 85). From this deficiency developed Gagne's instructional design theory.

Instructional design attempts to use knowledge from learning research and theory to develop an instructional system that "will optimize learning, retention, and transfer" (Goldstein, 1984:99). Below are summaries of the five categories of learning outcomes that form a basis for the objectives of instruction:

> 1. *Intellectual Skills*. The capabilities for making a human individual competent. It involves the knowledge of how to do something and draws on concepts, rules, and procedures. It is sometimes referred to as procedural knowledge.

> 2. *Verbal Information*. The "facts" that comprise much of the information passed on in an instructional environment. Alone they have little meaning, but they provide direction to learning and aid in the transfer of learning.

3. *Cognitive Strategies*. Describes the cognitive ability of individuals to know how and when to integrate intellectual skills and verbal information.

4. *Motor Skills*. Involves the physical act of human performance ranging from writing to steering an automobile.

5. *Attitudes*. Attitudes can often influence the choice of action of an individual.
(Gagne and Briggs, 1979:49-55; Goldstein, 1984:99)

To be effective, the objectives of instruction (that dictate the method) need to consider the different levels of learning outcomes identified above by breaking up a total task into distinct components that are defined by the five types of learning (Goldstein, 1984:65). A more effective transfer of learning from instructional setting to the work environment will result if tasks are broken out and properly defined and uniquely taught. In Gagne and Briggs' Principles of Instructional Design (1979), the use of the taxonomies developed by Bloom and Krathwohl described earlier are referenced as useful tools for this purpose.

Integrating the tasks required of a particular job only covers one aspect of the training environment. Gagne and Briggs (1979) also identify design instruction as part of the effort to emphasize learning outcomes as the goals of an instructional system and bring a knowledge of the learning process to bear on the design of instruction. This concept is known as the systems approach.

The Systems Approach. A systems approach to training instruction is identified as the most effective method for training development and evaluation (Goldstein, 1974:17;

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Ford and Wroten, 1984:651; Carnevale and Schultz, 1990:S-16) and involves the integration of organizational goals and training objectives. Essentially, the entire training program is an instructional system driven by the assessment of an instructional need within the organization. This need is then used to identify behavioral objectives that emphasize matching "training environments to required behaviors." (Goldstein, 1974:22)

Instructional Systems Development Process. The Instructional Systems Development (ISD) Process defines a specific systems approach to training development that includes evaluation. Gagne and Briggs (1979) define the ISD process as a series of iterative and cyclical stages that define an instructional system first at the system level, then course level, and finally lesson level (20-23).

Its structured methodology makes it well suited for Air Force use. Air Force requirements for an instructional system to equip members to perform a wide variety of jobs led to the development of its first major instructional system in 1965. The evolution of that system which covers a broad range of students, course lengths and subjects has produced the Air Force ISD model. Demonstrated gains in the efficiency of instruction that have resulted from this model has led to Air Force policy that directs the use of the ISD process (AFM 50-2:4).

The USAF ISD Model. The Air Force defines the ISD process as A deliberate and orderly, but flexible, process

for planning and developing instructional programs which

ensure that personnel are taught in a cost effective way the

knowledges, skills, and attitudes essential for job

performance (AFM 50-2:74). This process is implemented in

the form of a five step model identified in Figure 5 that

includes the following areas:

1. *Analyze System Requirements.* Involves determining
what the skilled performer does while doing the job,
how well he or she must do it, and under what
conditions.

2. *Define Education/Training Requirements.*
Determining if instruction is needed and, if so,
determining what instruction to give the untrained
personnel so they can do the job well.

3. *Develop Objectives and Tests.* Involves expressing
instructional needs as specific objectives and devising
test items for objectives to determine if they are met.

4. *Plan, Develop, and Validate Instruction.* Includes
the selection of media and methods, and also developing
validating and revising the instructional materials.

5. *Conduct and Evaluate Instruction.* Actually
conducting the instruction and then evaluating the
program by measuring the student's ability to
accomplish the above test items. (AFP 50-58, 1978:1-5)

ISD Model Application to CAT Leader Training. Research

into the history of CAT leader training has not indicated a

comprehensive systems approach in the course development--

which would include plans for evaluation. However, although

no complete instructional system was initially set up, the

established curriculum and syllabus allow the use of the ISD

model in CAT leader training evaluation and improvement.

As noted earlier, specific behavioral objectives

(system requirements) were identified relating to the

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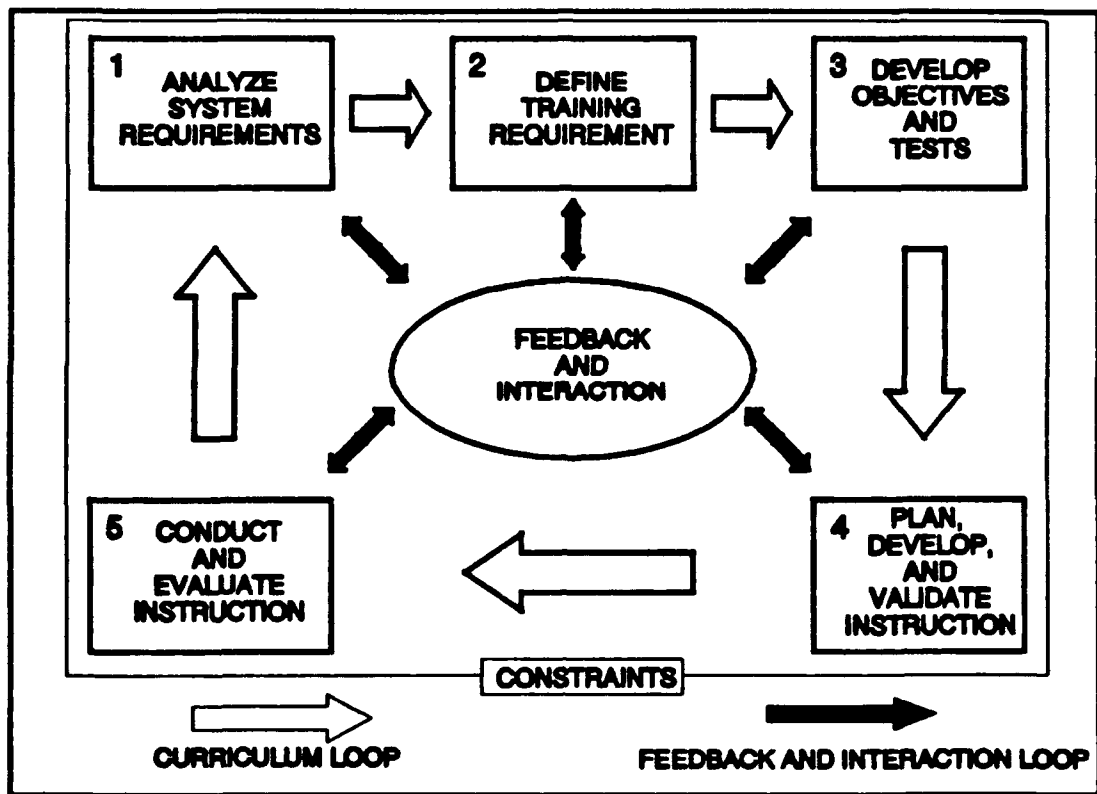
Figure 5. Instructional Systems Development Model (AFP 50-58:1-5)

transfer of learning to the organization (ASD/TQ, undated: Tab), these system requirements led to a course notebook and syllabus (training requirements) that have been established and implemented. This study constitutes addressing the final three steps in the ISD process that include testing, validating and evaluating instruction.

In chapter 1, the research scope was identified to include mainly evaluation of the current syllabus. Specific emphasis regarding analyzing system requirements (step 1), and defining training requirements (step 2) are left for future efforts. This leads to course evaluation being the

primary issue of this paper. The next section provides more background relating to this requirement.

Training Evaluation

This section considers issues related to the evaluation of a training program. The following paragraphs identify several underlying issues that relate to training evaluation and are designed to provide a general overview of evaluation approaches. Goldstein (1984) was found to provide the most comprehensive view of training evaluation found and is a highly encouraged reference for work in this area.

The Need for Training Evaluation. Training evaluation is an issue that is highly encouraged by most organizations, but seems to draw very little support in application. (Bunker and Cohen, 1988:4; Fisher and Weinberg, 1988:73). Reasons to evaluate are overshadowed by the many reasons given not to evaluate, or at least to do a cursory job. These reasons often include the fact that programs were developed by experts (Bell and Kerr:70; Bunker and Cohen, 1988:4), that good evaluation is too expensive (Zenger and Hargis, 1982:10; Bunker and Cohen, 1988:73; Fisher and Weinberg, 1988:73) or significant findings will not result (Arvey, et al., 1985:494). Unfortunately several sources identified fear of negative findings as another main reason for lack of evaluation (Bunker and Cohen, 1988:4; Fisher and Weingberg, 1988:73).

The perceived drawbacks to an evaluation program need to be examined with respect to advantages. The need to justify productive training as well as reduce the amount of ineffective training provides a strong basis to support evaluation (Zenger and Hargis, 1982:11; Bell and Kerr, 1987:70; Bunker and Cohen, 1988:5; Fisher and Weinberg, 1988:73) as does the emphasis on evaluation in the development of instructional systems and the systems approach to training (Goldstein, 1984; Gagne and Briggs, 1987).

Along with the justification for evaluation is the identified availability of standard research methodology that allows for meaningful evaluation of programs (Zenger and Hargis, 1982:11; Zammit, 1987:262; Bunker and Cohen, 1988:4).

Summative vs Formative Evaluation. Often when evaluation is considered, the focus is on an established system and just looking at the results it produces. Evaluation involves much more. To be comprehensive, evaluation must include the learner, the teacher, and the instructional design used to both develop and run the course (Knirk and Gustafson, 1986:215).

Formative evaluation focuses on the development of the course and then on improvements. It often is used to determine if the training program is operating as designed (Goldstein, 1984:148). Summative evaluation, on the other hand, involves the appraisal of an established program

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through investigating the effectiveness of instruction. Ideally, the use of both evaluations on a program would provide a good evaluation format. A formative evaluation would look at how close the program being implemented is to its design, and it would also investigate areas of improvement in instructional design. This would provide a firm basis for a summative evaluation to determine if stated course objectives are met.

In the summative area, several levels of criteria for evaluation are identified and are useful in defining the level of detail regarding training effectiveness and transfer. These four levels are defined below.

Kirkpatrick's Four Levels of Criteria for Evaluation. This model is used extensively by authors when considering evaluating training programs (Goldstein, 1974; Kirkpatrick, 1978; Ford and Wroten, 1984; Carnevale and Schultz, 1990). Kirkpatrick's four levels of criteria for evaluation include reaction, learning, behavior and results. Weeks (1986) provides a good summary of the criteria:

> 1. *Reaction.* Measures the degree to which people are satisfied with the training program. It often provides feedback on how course content, methodology, materials and instructors were received by participants, but does not measure learning (emphasis added).
>
> 2. *Learning.* Involves assessing whether or not trainees have acquired any new knowledges, skills or abilities during the classroom experience.
>
> 3. *Behavior.* Involves a measurement of a trainees performance at a job site. It attempts to identify and document changes in behavior which can be attributed or related to training experiences.

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4. *Results.* Involves measuring the impact of training activities to results regarding organizational goals and changes. (Weeks, 1986:22-23)

As indicated earlier, the ultimate issue involves the transference of learned behavior from the classroom to the work environment. Although the desired evaluation to measure effectiveness would continually point towards Kirkpatrick's Level 4 evaluation criteria (Results), that summative level of assessment is relatively difficult to obtain. The result is a reliance on the lower levels of evaluation that are easier to develop and implement, but provide less information (Weeks, 1986:23).

Goldstein identified a Catalanello and Kirkpatrick study which found that out of 154 companies surveyed, 77 percent stressed evaluation studies related to reactions (Goldstein, 1974:61). Prior to this research effort, CAT leader training fell into this category of evaluation since the only substantive evaluation involved review of critique forms provided at the end of the course.

Part of the problem for the reaction level emphasis is the level of difficulty in higher level assessments and the large number of factors beyond classroom training that affect both job performance and organizational results (Weeks, 1986:23).

Research design is a major issue that relates to many of the factors that can confound an evaluation. The selection of a design and methodology and the implementation of the research provide a means to effectively meet

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evaluation objectives of time, money, and information. The
next section discusses the use of a research design in
training evaluation.

Research Design

Research design discussions were prominent in training
evaluation literature (Goldstein, 1974; Bunker, 1978;
Kirkpatrick, 1978; Zenger and Hargis, 1982; Zammit, 1987;
Carnevale and Schultz, 1990). Almost all discussions
involved the use of designs proposed by Campbell and Stanley
(1963). These include pre-experimental designs, true
experimental designs, and quasi-experimental designs. The
use of pre- and post-testing was also highly recommended for
evaluating learning in a training program, as was the use of
control groups (Goldstein, 1974; Bunker and Cohen, 1978;
Zenger and Hargis, 1982; Kirkpatrick, 1978; Carnevale and
Schultz, 1990).

Research rigor does come at a cost, and requirements or
resources must be considered when reviewing possible
evaluation approaches. No more rigorous design should be
used than required (Kirkpatrick, 1978; Carnevale and
Schultz, 1990).

Often a main criticism of research deals with the issue
of validity. In Mitchell's article *An Evaluation of the
Validity of Correlational Research Conducted in
Organizations* (1985), one anonymous respondent to a
Campbell, Daft, and Hulin paper (1982) was quoted describing

the major concern of using very powerful and computer-related statistical techniques to draw conclusions from questionable measurement instruments (Mitchell, 1985:192). Clearly, any research conclusions need to be considered with respect to the validity of the instruments and research methods.

Internal/External Validity. Evaluation is mainly directed at two specific issues: internal and external validity. Internal validity involves the degree of in-class learning that results from training and external validity involves the accuracy of applying training behavior to actual on-the-job performance (Bunker and Cohen, 1978).

Content Validity. Content validity refers to the applicability of training related criteria to on-the-job application and addresses some aspects of external validity.

A quantitative approach to assess job-relatedness was developed by Lawshe (1975) and involved measuring the content validity of individual test items of a selection test by having "subject experts" rate each test item as it was applicable to a specific job.

The Content Validity Ratio (CVR) rates training specific knowledges, skills, abilities and other personal characteristics (KSAOs) as having job application. The usefulness of this approach involves two assumptions. The first assumption is if more than 50% of the "subject experts" rate a particular KSAO as important, it has some degree of job relatedness. The second assumption is that

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the more experts who rate it as important, the greater
degree of content validity (Lawshe, 1975; Ford and Wroten,
1984).

The following formula describes the linear
transformation that defines the CVR:

$$CVR = \frac{N_f - N_i}{N_f}$$

Where N_i is the number experts who rate a task as
essential and N_f is the total number of raters.

Each training item is identified as a task that will be
rated by the content experts as either essential (1), useful
but not essential (0), or not necessary (-1).

The CVR was originally introduced to aid in identifying
content valid test items (Lawshe, 1975). Its application to
training evaluation was identified by research regarding
police recruit training (Ford and Wroten, 1984). Several
research applications have modified the CVR approach to
measure content validity of a training post-test (Distefano,
et al., 1980), the content validity of training elements
(Ford and Wroten, 1984), and the content validity of
behavioral rating scale criterion (Distefano, et al., 1983).

The application of the content validity ratio to
training related areas has demonstrated the usefulness of
this procedure in supporting the content validity
conclusions in several research efforts.

Summary

This chapter reviewed the general theories of learning and several aspects of the instructional system design approach. Since this research involves the evaluation of a training program, emphasis was placed on this area of instructional system design and included specific literature dealing with training evaluation and research design.

Chapter 4 will now take much of the information just discussed and provide a methodology that focuses specifically on the research accomplished for CAT leader training.

IV. Method

Introduction

This chapter discusses the methods used in accomplishing the research objectives. It describes the identification of a training approach and the development of behavioral objectives. These objectives were the basis for developing a knowledge test for an internal course evaluation, and were also used for developing a questionnaire for a field evaluation. Statistical analysis was used on the data collected to answer the majority of the research objectives.

Restatement of the Research Objectives

The following objectives identified in Chapter 1 form the basis for the research direction. For reference, the research objectives are again provided:

1. Identify and document the specific material provided as part of the current course curriculum.

2. Determine if the CAT leader training course facilitates learning of the course material and improves a trainee's self-efficacy regarding application of course material.

3. Determine the characteristics of current corrective action teams and the involvement of graduates.

4. Identify the level of self-efficacy of past attendees regarding application of course material.

5. Identify how past attendees perceive and apply the problem solving tools and techniques provided in the course.

6. Based on the above objectives, provide the Commander of ASD with recommendations for improvements to the current CAT leader training curriculum.

General Research Direction

The general research method involved using data from several sources to address the research objectives and answer the research questions. Since only past course critiques were available on the training to date, secondary data sources were not available, making primary data the principal source of information.

The Commander's Office for Total Quality (ASD/TQ) is the host of the ASD CAT leader training program and sponsored the course evaluation research. They made available all necessary resources for support. For data collection, ASD/TQ supported an in-class evaluation of four courses and provided attendance rosters for all previous classes that identified the course population of 440 individuals.

The following paragraphs identify the specifics associated with the effort.

Identifying Training Objectives

Currently, CAT leader training has three overall objectives that were first identified in Chapter 2. They include training a CAT leader:

1. To be able to organize a corrective action team and manage the group dynamics so that the CAT develops into and remains an effective, functioning team.

2. To be able to explain the TQ structure and philosophy to individual members and how the CAT fits into the overall TQ process.

3. To be able to teach the problem solving methodology and the appropriate tools and techniques to CAT members so that they are able to effectively use them in the problem solving process. (ASD/TQ, undated:Tab)

These objectives explain the goals of the training well as it relates to ASD and could properly be named "terminal objectives," because they identify what a CAT leader should be able to accomplish after completion of the program (Goldstein, 1974:21). However, to measure the terminal objectives by a test instrument, the identification of subobjectives is required to measure individual criteria of the training. Subobjectives measure subskills necessary to master terminal objectives (Zammit, 1987:252). Since no subobjectives previously existed, the initial step in the research required their development.

Developing Specific Subobjectives. Both terminal and subobjectives (hereafter both referred to as "objectives") are behavioral objectives that make statements about behaviors and content (Zammit, 1987:255).

Behavior statements include action verbs that identify requirements of students (e.g., understand, describe, select, etc.). Content statements involve specific subject matter, like steps in a process. The three behavior statements proposed for CAT leader training objectives included:

1. Have an appreciation for

2. Identify the steps, functions, diagrams and definitions

3. Know the principles of

The content statements proposed for CAT leader training objectives included:

1. The steps in a technique.

2. The stages in a model.

3. the steps in a process.

These statements were used to develop objectives relating to the CAT leader training blocks identified in Figure 2. These blocks included: Overview of Total Quality Management, Effects of Personal Values, Group Dynamics, the Problem Solving Process, Problem Solving Tools and Techniques and Meeting Effectiveness. The CAT leader notebook provided to all attendees since training began in 1989 was thoroughly reviewed to generate a comprehensive list of proposed course objectives. Recommendations for additional objectives not identified were requested during the review cycle.

Review of Proposed Objectives. Objectives developed from the content of the training blocks described above were initially provided in the form of a questionnaire to twelve employees of ASD with recent CAT leader training experience. They included four past course instructors and eight recent attendees. Since the objectives were to mirror the current course (and not to identify improvements), reviewers were

instructed to make comments related only to the current

course curriculum. They were also asked to apply the

following criteria to their review:

1. Are all objectives applicable to the training?

2. Is the scope of required knowledge (have an
appreciation for, identify, and know) for each
objective appropriate?

3. Are there missing objectives?

4. Are the objectives clear and concise?

Comments were collected and an updated set of proposed

objectives (with changes noted) were again distributed to

the same individuals. In addition, proposed objectives with

the same review guidelines were also provided to several

experts in organizational research knowledgeable in training

programs.

Format and content changes were reviewed and

incorporated from the comments received. Objectives were

categorized into training blocks as they are organized in

the CAT leader notebook and the course syllabus (ASD/TQ,

undated:Syllabus). A set of developed course objectives is

provided in Appendix B. Only objectives dealing with the

current course curriculum were allowed.

Content Validity of the Objectives. Since a validated

set of objectives is required to ensure the development of a

reliable knowledge test and questionnaire, it was necessary

to ensure that actual instruction addressed those

objectives. To accomplish this, questionnaires were

provided to the 12 members of the current course instructor

cadre. The instructors were asked to review the objectives

and rate each on the scale identified in Figure 6 as they

relate to their own presentations:

```
(1)  I completely cover this objective
(2)  I partially cover this objective
(3)  I do not cover this objective
(4)  I have never taught this section of the course
```

Figure 6.   Instructors Options to Identify What
             Objectives are Taught in CAT Leader Training
             (modified from Lawshe, 1975)

Since the course is team-taught, option four was

included to account for those instructors who have never

presented a particular training block.

Nine of 12 instructors returned the objectives rating

form (including the four facilitators who normally conduct

the training). The rating forms were scanned and the raw

data analyzed using a modified version of Lawshe's (1975)

Content Validity Ratio (CVR) technique discussed in Chapter

3. Specific objectives were considered to be completely

covered in class *by all instructors* if the corresponding CVR

was greater than or equal to an established minimum CVR

standard ($p < .05$). This standard value is drawn from

Schippers' computations that considered both the confidence

desired and the number of reviewers (Lawshe, 1975:568).

Because of the small sample size (N=9), CVR frequency

calculations were performed using the software package Statistix[ts] on a 386SX personal computer.

The values of individual CVRs for objectives are located in Appendix C and form the basis for answering investigative question 1 that relates to the curriculum taught by course facilitators. Since the proposed objectives were the basis for the knowledge test, the results of the content validity calculations became useful both to identify valid course objectives and validate test items. A discussion of the knowledge test development is provided in the following section.

Development of Knowledge Test

The knowledge test was the primary instrument for the internal evaluation of the course. It was designed as a summative evaluation instrument to assess the effectiveness of the course design and delivery (Zammit, 1987:252), and address research objectives 2, 3 and 4.

A knowledge test is a criterion-referenced test that measures specific behavioral objectives (Goldstein, 1984:134). It involves pre-testing and post-testing the training subjects to assess how well students master the objectives developed for a course. As discussed in the scope of the research project in Chapter 1, the knowledge test involved the knowledge and comprehensive levels of learning (Bloom, et. al, 1971). As a result, the questions

were developed from those objectives where the requirement was to know or be able to identify course material.

Testing Design. Variables measured during testing are associated with the behavioral learning objectives of training (Goldstein, 1974:73), and involve the following experimental design format:

$$O_1 \quad X \quad O_2$$
$$X \quad O_2$$

Where O_1 was the pre-test, X the training, and O_2 the post-test (Campbell and Stanley, 1963:7). This design is a derivative of the pre-test/post-test pre-experimental design commonly used in instructional settings that provides a measure of comparison to the same group of subjects (Goldstein, 1974:79). The control group involved one class of subjects who took only the post-test after training, but not the pre-test. Data was collected from this group to indicate effects of student questions prompted by the pre-test. The short time duration of training should limit the internal validity threats due to maturation and history. However, the impact of pre-test sensitizing on post-test scores is a concern.

Test Writing. Questions were placed in two separate sections of the knowledge test located in Appendix D. Section 1 involved personal/organizational topics and collected demographic data and the student's past experience with teams and training associated with portions of the

course curriculum. At the end of this section, 5 questions related to self-efficacy were also provided. These self-efficacy questions were again repeated in the questionnaire given to past course attendees.

Section 2 of the exam addressed CAT leader training material identified by the training blocks in Figure 5. Questions were developed based on those objectives that required a "knowledge of" or an "appreciation for" the material. Sixty-three questions were written by the researcher under the following guidelines:

1. Ensure each test item matches an objective.

2. Ensure all information required for an appropriate response is provided.

3. Ensure each test item is clearly stated.

4. Ensure only relevant material is provided.

5. Review all test items for content.

6. Have instrument reviewed and pretested.
                    (Zammit, 1987:257; Emory, 1985:228)

Guidelines 1, 2 and 4 involved question content, 2 and 3 involved question wording, and 5 and 6 involved item review (Zammit, 1987:257).

The test was reviewed by Air Force Institute of Technology (AFIT) faculty who are experts in testing and organizational theory and included issues such as: test question content applicability to behavioral objectives, the presence of unstated or misleading assumptions, the presence

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of wording bias, and question scope and clarity (Emory, 1985:228).

Since the knowledge test was written prior to validating behavioral objectives, sixty-three questions were developed for the test instrument. Of those sixty-three questions, seven were related to objectives which had negative CVR values. The results of these items were not considered in any assessment of student performance.

Pre-testing. Pre-testing was accomplished with ten AFIT graduate students to identify test question clarity and completeness and also ease of answering (Emory, 1985:207). The students were selected based on availability and were screened to ensure they had not previously received CAT leader training. Current CAT leader training instructors were not included in the review to preclude their bias toward teaching test material during data collection.

Improvements were made to the exam that included increasing the age options available for demographics, highlighting negative response questions, and providing more of a random order to the matching portions of the test.

Knowledge Test Data Collection. Each exam began with an administrator providing instructions to the students. Four classes were tested in consecutive months. A post-test was given to the control group in March, followed by three groups receiving both the pre-test and post-test set in April, May, and June.

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The researcher administered the test for the first two classes and provided instructions for the third. The two instructors who facilitated all three classes tested were provided instructions and administered the third exam.

Each participant received an exam, an optical score sheet (AFIT Form 11D), and a #2 lead pencil. In all cases, the classes were told the general scope of the research and it was stressed that individual raw scores were not an important part of the research requirements. These steps were taken to limit threats to validity by participants who might interpret the knowledge test as a source of criticism or grading (Bloom, et al., 1971). The first set of data collected involved the post-test group that completed CAT leader training on 29 March 1991. Testing results coded on optical scan sheets were read into a file for analysis.

Knowledge Test Population. The post test control group consisted of 17 students from the Special Forces System Program Office (ASD/VX). They contained a slightly higher proportion of middle management, but still covered all ranges of personnel. The population tested both before and after training consisted of forty-four students in three classes from organizations throughout ASD. Nine students were military a third of whom were enlisted, with officers representing the ranks of lieutenant through major. Thirty-two civilians were included in groups ranging from GS-03 to GM-14. Three contractors attended. The median age of all

subjects was 36-40 years with a nearly equal representation of both men and women.

Knowledge Test Reliability. Reliability involves determining how well an instrument can consistently produce the same results over time. High reliability indicates that variance in the scores is not due to chance arising from a flawed measuring instrument (Guion, 1965:27).

Reliability calculations were used to determine Cronbach's alpha coefficient that is interpreted as the average of all possible split-half reliabilities. Using the Fifty-five test items developed from validated objectives provided a Cronbach alpha coefficient of 0.89, indicating a good to excellent reliable test instrument (Shane, 1991). Review of the frequency distributions for the questions showed a range of responses for each test item that gave no indication of overly easy or poorly written test questions. Additionally, no significant changes in reliability were identified when individual items were removed and reliability re-calculated.

Based on the promising post-test results, three experimental groups receiving CAT leader training during the months of April, May, and June were given the knowledge test on both the first and last days of training. These three groups were selected to improve statistical power. In addition to an increased sample size for statistical purposes, several groups were selected to measure any

effects that result from a particular instructor. However, measuring the effects of particular instructors was not possible since the same instructors actually taught all the classes tested. These instructors reviewed the course objectives, but were not exposed to the test instrument.

Each class took a pre-test on the Tuesday morning opening of the course and concluded Friday's course requirements with the same knowledge test now representing a post-test. The Cronbach's alpha coefficients are identified in Table 1 for each of the sets of tests. As shown, each course reliability figure indicates a highly reliable test instrument.

Table 1
Knowledge Test Reliability

Type of test	N	Dates	Cronbach's Alpha
Post-test	17	29 Mar 91	.89
Pre-test	44	9 Apr 91 14 May 91 11 Jun 91	.85
Post-test	44	12 Apr 91 17 May 91 14 Jun 91	.89

Development of CAT Leader Training Questionnaire

The questionnaire was the primary instrument for the field evaluation. It was designed to address objectives 3, 4 and 5 of the research in determining the extent that training material is applied and how it is perceived by CAT

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leaders in the ASD environment. Since there was a
reasonably small population of past attendees (440
students), the use of a short questionnaire was viewed as
the most efficient and economical option to collect the data
to address the objectives (Emory, 1985:158). Confidential
responses and guidelines required by the Privacy Act of 1973
also promoted an honest response to questionnaire items.

Testing Design. Variables measured during field
evaluation are associated with the transfer of the
behavioral learning objectives of training (Goldstein,
1974:73). This testing involves a pre-experimental design
of a one-shot case study having the format:

$$X \qquad O_2$$

Where X is the training, and O_2 is the questionnaire
(Campbell and Stanley, 1963:6). Since no previous data was
available, the one-shot case study was chosen to collect
perceptions from CAT leaders. While it is possible to
measure the application of course material, measuring any
change in attitude or perception is not possible (Weisberg
and Bowen, 1977:88). As a result, this portion of the
research is limited to only providing a snapshot of material
application. The ability to then conclude that the training
received was the responsible factor leading to the behavior
change is very difficult to support. However, future
research may use this data to draw such conclusions.

Questionnaire Population. The population of interest were those ASD employees who had received CAT leader training. As of May 1991, 440 individuals have received CAT leader training from 23 different course offerings. While many Air Force organizations have sent personnel to CAT leader training, questionnaires were distributed only to the 373 individuals associated with ASD, the sponsor of the research.

The population included members of all military and civilian ranks and grades. Military members ranged in rank from enlisted to the rank of colonel and civilian attendees included GS-03 through GM-15. Five contractors also responded to the questionnaire. The median age of respondents was between 36-40 years. Men represented almost 2 out of 3 respondents.

Questionnaire Format. The entire questionnaire package consisted of five parts: the cover letter, one questionnaire, an optical scan response form (AFIT Form 11C), a list of definitions, and an addressed return envelope. The package was reviewed and approved by the Commander's Office for Total Quality (ASD/TQ). The cover letter that introduced the questionnaire was signed by the Commander's Assistant for Total Quality and provided the respondent with a brief background on the project and encouraged participation.

The questionnaire itself was divided into six separate sections identified in Figure 7. Each section title was followed with a brief summary which identified to the respondent the type of information that was being furnished in that section. This additional information was supplied to further inform the respondents and encourage their cooperation in completing the instrument (Emory, 1985:158-159).

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Section 1:   Personal/organizational
Section 2:   Training Information
Section 3:   Assignments and Status of CATs
Section 4:   Perceived Abilities
Section 5:   Use of Tools and Techniques
Section 6:   General Comments
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Figure 7.   Sections of CAT Leader Training
            Questionnaire (Appendix E)

Section 1 requested general demographic information regarding the characteristics of respondents who have taken CAT leader training. Section 2 requested information regarding the date of training for the respondent and whether that individual was still in the organization that sponsored their training slot. Section 3 requested information on the level and type of CAT involvement and the current status. Section 4 measured each respondent's level of self-efficacy in regard to performing tasks related to the CAT leader training curriculum. Section 5 provided

information on the level and frequency of use of problem

solving tools and techniques that were introduced in CAT

leader training. Since many respondents may not have

recognized some of the tools and techniques identified, a

reference was made to a list of definitions provided as an

attachment in the questionnaire package (Appendix F).

Section 6 solicited feedback on any of the previous sections

of the questionnaire and the CAT leader training course

itself.

Items were written by the researcher using the

following guidelines;

1. Ensure all information required for an appropriate
response is provided.

2. Ensure each test item is clearly stated.

3. Ensure only relevant material is provided.

4. Review all test items for content.

5. Have instrument reviewed and pretested.
(Zammit, 1987:257; Emory, 1985:228)

Guidelines 1 and 3 involved question content, 2

involved question wording, and 4 and 5 involved item review

(Zammit, 1987:257). The test was reviewed by AFIT faculty

who are experts in testing and organizational theory and

included issues such as: the presence of unstated or

misleading assumptions, the presence in bias of wording and

question scope and clarity (Emory, 1985:228).

Pre-testing. Pre-testing was accomplished with three

CAT leader training facilitators, the CAT leader training

course director, the ASD/TQ focal point on measurement, and four employees of ASD with experience in TQM. A set of proposed hypotheses was also provided with the questionnaire and each test candidate was requested to complete the survey and review each item for clarity, ease of answering, and applicability (Emory, 1985:207).

Improvements were made to the questionnaire that included adding section titles and summaries, modifying the training date options from two questions to three questions and dividing the tools and techniques options into three categories (level of use, frequency of use, and usefulness) with corresponding changes in their associated Likert scales. A general comments section was also added to solicit additional feedback from the respondents.

Questionnaire Data Collection. Several days prior to questionnaire distribution, a summary of the research plan and objectives was sent to all TQ coordinators in ASD. The goal was to notify ASD personnel associated with TQ about the research and encourage them to notify past CAT leader training attendees to expect a questionnaire.

The entire questionnaire package was mailed out via the ASD internal mail system in the first week of May 1991 to all past attendees of CAT training in ASD. The mailing list was developed from the attendance lists for the training classes and included ranks when provided. Each envelope identified the course graduate, his/her organization, the

training date, and a request to forward. The training date was provided on the label so that information could be collected in Section 2 and conclusions drawn for different classes. The return envelope was addressed to ASD/TQ with responses requested by 14 June 1991. This five-week time period allowed for questionnaire responses that considered mail delivery, response time, and possible forwarding to reassigned ASD personnel. As stated earlier, 373 questionnaires were distributed. After 2 weeks, 166 (45%) were returned with a total after 5 weeks reaching 222 (60%). Of the 222 returned, 13 were not completed due to changes in address, unavailability of the individual, and resignations. This provided an overall response rate of 208/373 (56%) and was considered an excellent response considering that some of the class rosters used to develop the mailing list were over 1 1/2 years old. Responses were received and coded into a data file. Questionnaire responses were collected on the AFIT Form 11C that allowed for optical scanning of the data for coding and analysis. Additional comments were collected in Section 6 of the questionnaire and are provided in Appendix G.

Data Analysis

Analysis of the data from both the knowledge test and questionnaire was defined by the requirements of the specific research questions identified in Chapter 1. As described earlier, the content validity requirements for the

objectives was established using a modified version of Lawshe's (1975) content validity ratio (CVR) and content validity index (CVI). This provided a basis for the credible analysis of the knowledge test and questionnaire data.

Both sets of data were collected on optical scan sheets (AFIT Forms 11D and 11C respectfully) with calculations being handled on a VAX 6420 computer using the Statistical Analysis System (SAS) software (version 6.0). Table 2 identifies the 11 research questions and the associated statistical tests that were required to address each question.

Table 2
Statistical Tests for Investigative Questions

Question	Measurement Instrument	Test
1	Training Objectives	CVR/CVI
2	Knowledge test	Paired T-test
3	Knowledge test	Simple Regression
4	Knowledge Test	Paired T-test
5	Questionnaire	Chi-square
6	Questionnaire	Chi-square
7	Questionnaire	Ind-Sample T-test
8	Questionnaire	Chi-square
9	Questionnaire	Chi-square
10	Questionnaire	Chi-square
11	Questionnaire	Chi-square

The above questions require several statistical
techniques to provide a confident analysis. Since
parametric tests were used, the assumption of normality was
required. All variables which contained a Wilk-Shapiro
statistic for goodness-of-fit to the normal distribution in
excess of .70 were considered to meet the normality
requirement (Shane, 1991).

T-test. The t-test involves the comparison of two sets
of sample data to draw conclusions regarding the association
of their underlying distributions. The two types of t-test
that are used in this research are the independent-sample
and paired t-tests.

An independent-sample t-test can be performed to
determine if the sample data was probably drawn from
different distributions. Assumptions regarding this
application are that both populations that provided the
samples are normally distributed and the population
variances are equal. Since the estimate of the variance is
drawn from both sample data sets, often a pooled estimator
is used to identify the common variance. This pooled
estimator provides a weighting to the variance that
considers the relative size of each sample (Devore,
1987;334-336).

The sample means and common variance are used to
compute a t-statistic for a two sided test. High t-

statistics translate a lower probability that the samples are from the same distribution.

While the normal t-test uses independent samples, the paired t-test involves the comparison of two separate but dependent samples. In this research, many of the comparisons involve pre/post test data where the measuring instrument and test subject are the same and the effect of treatment (training) is what is being measured. In this case, the two sets of data are dependent and the t statistic developed provides insight as to whether the treatment had a significant effect on the subject.

The statistic of interest is the difference between the mean values for each measurement. The pre/post test approach is designed to remove the effects of factors other than the treatment to determine a measurable difference (Hamburg, 1977:306). No change due to the treatment would mean that there was no statistically discernable difference in the paired observations (i.e. the treatment had no impact on what was measured). The assumptions underlying the paired t-test are that the selected pairs are independent and the difference in pairs are normally distributed. A common variance is not required in this case since the variable of interest is the difference in sample means, and this variable has its own variance that can estimate the population variance (Devore, 1987;344-345).

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Regression. Regression analysis involves determining the statistical relationship between two or more variables (Devore, 1987:451). In simple linear regression analysis, values of independent variables are often helpful in predicting the value of a dependent variable. In CAT leader training specifically, investigative research question number 3 involves the ability of three variables to predict the value of the subject's knowledge pre-test score. Those three predictors are past training, past education, and past experience.

The equation of interest is linear and is defined as: $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \epsilon$. Y is the dependant variable and each portion of the right hand side of the equation defines the corresponding slope (β) associated with the three independent variables. The ϵ represents the error term of the model and is assumed to be normally distributed with a mean of zero. Each of the independent variables is considered a significant predictor of the knowledge test, if its slope is greater than zero.

It is important to examine the aptness of the model for the data being used before extensive analysis is performed (Neter, et al., 1990:113). Aptness provides confidence that the regression model is competent for use (Reynolds, 1991).

Study of the residuals is one method to ensure that the model assumptions fit the data being examined. Plots of residuals against independent variables, fitted values,

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time, and omitted independent variables are methods to visually check data trends that result in model departures. (Neter, et al., 1990:117). Informal diagnostic review of residual plots provide information on whether departures from the simple linear regression model would preclude its use.

Chi-square test. The chi-square (χ^2) distribution is a probability distribution that is defined by the parameter v (degrees of freedom). Often the chi-square distribution is used to identify the goodness of fit between observed frequencies and theoretical frequencies (Hamburg, 1977:318). In some of the investigative questions considered, the issue of whether individuals meeting specific criteria are represented by categories that are randomly distributed.

In this research, each category of a variable being investigated is considered to be mutually exclusive, collectively exhaustive, and randomly distributed. If this is not the case, then some categories of a variable will have a disproportionate level of subjects. The chi-square goodness of fit test is a method that allows you to test if a disproportionate level exists. The chi-square test requires that each category contain at least five observations.

These three testing techniques defined above represent the statistical approach used in drawing conclusions to the

investigative questions from the research data. These
results will be addressed in the next chapter.

Summary

This chapter outlined the methodology associated with
accomplishing the research objectives and answering the
specific research questions. The development and validation
of a set of behavioral learning objectives provided the
framework for both an internal and field evaluation of the
training through the use of a knowledge test and
questionnaire, respectively.

With Chapters 1 through 4 as a background and the data
collected by the knowledge test and questionnaire, results
and recommendations can now be addressed and discussed.

V. Presentation and Discussion of Results

Introduction

As stated in Chapter 1, the investigative questions provided the specific guidelines for the research and were a means for a detailed breakdown of the research objectives. Consequently, they are the primary topics of discussion regarding results.

Each investigative question will now be identified and discussed based on the data collected and statistical tests performed.

Investigative Question 1

Is the basic curriculum described by the information in the CAT leader notebook taught by all course facilitators?

Chapter 4 discussed the development of learning objectives both to measure the three course terminal objectives and to provide a basis for development of a knowledge test and questionnaire. The information to develop the learning objectives came from the CAT leader notebook which contained the course syllabus and related material. Nine of the 12 instructors responded to the list of proposed objectives located in Appendix B and provided the data for content validity ratio (CVR) calculations. The values of individual CVRs for objectives is located in Appendix C.

Table 3 identifies that of the 62 objectives proposed, 55 had a positive CVR which indicates that the majority of

instructors completely taught those objective when
responsible for that training block during class. The 7
items with a negative CVR were not considered valid
objectives taught by instructors since less than half stated
they completely covered the objective in the course. These
seven included:

Objective 4: Identify the expected life of the four
major sub-systems that make up an organizations' TQ
structure from a list of options.

Objective 6: Have an appreciation for the difference
between maintenance factors and motivational factors
identified by Herzberg.

Objective 23: Have an appreciation for the strategies
of managing difficult people developed by Manning and
Haddock.

Objective 24: Identify some barriers to effective
communication.

Objective 26: Know the principle for giving and
receiving feedback.

Objective 57: Identify a diagram in the CAT leader
notebook which represents a Solution Selection Matrix.

Objective 60: Identify a diagram in the CAT leader
notebook which represents a Force Field Diagram.

The content validity index (CVI) which is the
arithmetic mean for all positive CVR items, had a value of
.73. It represents the extent of perceived overlap existing
between the objectives identified and the material taught in
the course. This high value indicates that there is a
substantial overlap between the objectives and the course
content.

Results indicate fifty-five of the 62 objectives were
completely taught by the majority of instructors with 36 of

Table 3
Results of Content Validity Calculations

Objectives covered by all instructors (p < .05)	36
Objectives covered by majority of instructors	19
Objectives not covered by majority of instructors	7
Total	62
Content Validity Index of top 55 objectives = 0.73	

those covered by all instructors (p < .05). This indicates that the instructors rated the content of their presentations as sufficient to cover the fifty-five objectives. Whether the student actually did perform to a level required by the objectives is a topic for investigative question 2.

It should be stressed that this was a self-rating scale based on the material as presented by an instructor. Some concern about self-rating is warranted, but not totally supported by the data. First, a wide range of CVRs was noted, indicating that instructors did not provide the maximum rating of 1 in all cases, and did identify where objectives were not completely covered. Second, the rating list in Appendix B was provided to the facilitators as a set of "proposed" objectives. "Proposed" carries less of an evaluation stigma which may impact the instructors' scoring. If instructors perceived their review of objectives as an evaluation tool, they would be more likely inflate their scores. Requesting anonymous responses to a list of "proposed" objectives attempted to limit this problem.

While three of the part-time facilitators did not respond to follow-up, these results do provide confidence that these objectives properly reflect course material since the respondents who did respond represent over 85% of the instructor cadre and teach above that proportion of the total course.

Conclusion. The CVR and CVI scores indicate that 55 of the 62 proposed objectives developed from the material in the CAT leader notebook are presented by the facilitators during the four day course. They represent an initial set of validated objectives and are useful in developing the knowledge test and questionnaire. The seven objectives not taught completely by instructors are not necessarily improper for the course, but do not receive the same emphasis as other material. As a result, test items developed from these seven objectives will not be considered in the analysis of overall knowledge test results.

Investigative Question 2

> Does CAT leader training improve the knowledge of
> participants in each of the training blocks presented?

The validated objectives discussed in investigative question 1 provide a basis for determining if knowledge increased as a result of the course. Of the 55 objectives, 27 required more than just an appreciation for a concept. These objectives provided the basis for the knowledge test and began with the word "identify" or "know".

The knowledge test scoring results are divided into two areas: topics related to training blocks and individual tools and techniques.

Table 4 identifies the overall results from the three classes (N=44) evaluated by the knowledge test. Total score results are identified in the first row and then material is broken down by topics tested. The last four entries describe methods of testing tools and techniques. The number of questions, mean score change from the pre-test to the post-test, and paired t-test results are provided in columns two to four. A t-test result lower than 0.05 in row number four indicates a 95% confidence that a significant improvement is made in the post-test score.

All variables associated with valid objectives (positive CVR) were checked for normality using the Wilk-Shapiro statistic. Since the variables measured the improvement in score from the pre-test to the post-test, a discrete distribution resulted. Even though the normal distribution is continuous, the range of discrete responses allowed comparison to a normal distribution.

In all cases but two, variables were found to very closely approximate a normal distribution (Wilk-Shapiro statistic > .90). The two variables that had distributions that less closely resembled the normal distributions involved the Strength Deployment Inventory (SDI) (Wilk-Shapiro=.68) and Leadership (Wilk-Shapiro=.71). Each of these variables were represented by one question on the

knowledge test which limited the range of values in their discrete distributions. Since Wilk-Shapiro values in excess of .70 were considered acceptable in assuming normality, all topics, except SDI, met the established normality criteria for parametric tests (Shane, 1991).

Table 4
Training Block Results - Overall

Training Block	No. of Questions	Mean Change	Prob>¦T¦
Total Score	56	9.90	0.00
Total Quality	12	1.61	0.00
SDI	1	0.14	**
Group Stages	10	1.39	0.00
Leadership	1	0.07	0.41
Problem Solving Steps	6	1.36	0.00
Types of Data	4	0.36	0.14
Definitions	9	2.27	0.00
Use of Tools	4	0.39	0.07
Steps of a tool	5	1.07	0.00
Select diagrams	4	1.25	0.00
** = did not meet normality assumption for t-test			

Overall Score Improvement. The mean change in overall score for the three classes was 9.9 for the 56 question test. This shows that the average student improved their correct response score by almost 10 questions from the pre-test to the post-test.

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The concern about test sensitizing due to the short time between pre-test and post-test is addressed by the post-test only group. The knowledge test design was based on a pre-test/post-test pre-experimental design involving a control group. This control group was not exposed to the knowledge test until after the course was completed. Their post-test results (N=17) were compared to the combined post-test results (N=44) from the other classes and a pooled t-test was performed on the overall test score. The pooled t-test involves two distributions assumed to be normally distributed and uses a pooled estimator of the common variance. (Devore, 1987:334-336).

The resulting t-statistic produced a p-value equal to .07 and does not indicate that a significant improvement in score is attributable to exposure to the knowledge test prior to the course. The positive t-value does indicate a slightly improved post-test score from the control group, but not one large enough to draw a separate conclusion (p < .05).

Individual Training Material Improvement. The results in the total score row of Table 4 involve all the test questions that make up the overall score. All training blocks are represented except Block 6 (meeting effectiveness) which had no objectives measurable by pencil and paper testing. Of the nine sets of questions identified that met the normality assumption, six showed significant

improvement and three showed no significant improvement
(P < .05). SDI t-test results were not computed.

The six showing improvement questions relating to:
total quality, Tuckman's stages of group development, steps
in the problem solving process, tools and techniques
definitions, the steps of specific tools and techniques, and
diagrams associated with specific tools and techniques.
These six sets represented 52 of the sixty-three questions
in the knowledge test.

The three sets of questions that did not indicate a
significant improvement consisted of nine of the 10
remaining questions. They included the subjects of:
functions of a leader, types of data, and uses for specific
tools and techniques.

The types of data test questions involved
differentiating between qualitative and quantitative data.
The knowledge test had four questions addressing types of
data. Two questions required students to identify problem
solving tools and techniques associated with either
qualitative or quantitative data. Two additional questions
required students to differentiate between the types of data
from a list of examples. Since the scores did not improve
significantly (p < .05), students appeared to have a limited
improvement in understanding the definitions and
applications of data types.

Also, use of specific tools and techniques did not show
improvement. Four test items required the student to

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identify from a list the inappropriate tool or technique associated with a problem solving step (defining a problem, gathering information, etc.). The appropriateness of specific tools and techniques was defined by a summary sheet provided in the CAT leader notebook. Since scores did not improve significantly ($p < .05$), students appear to have a limited improvement in understanding the appropriate use of tools and techniques in specific problem solving steps.

Review of both sets of test item scores indicates that lack of improvement was not due to relatively high pre-test scores which would have left little room for improvement.

Since only one question each in the test involved SDI and leadership, their lack of improvement may partially be explained by the small number of questions which limited the range of scores for each subject. Limiting this range results in overall smaller variation among scores, making it more difficult to identify significant changes.

Another method to identify significant changes (or lack of) in the testing group is to review the results by individual classes.

Individual Class Results. Individual class scores were combined to determine the overall results. Since each class had its own population and teaching environment, their individual results show several aspects of training impacts not visible in the overall scores. Table 5 breaks down the training material results per class.

Table 5
Training Block Results - Per Class

Training Blocks	Improved Score (p < .05)		
	April	May	June
Total Score*	X	X	X
Total Quality*	X	X	X
Group Stages*	X		X
Leadership			
Prob Solving Steps*	X	X	X
Types of Data		X	
Definitions*	X	X	X
Use of Tools		X	
Steps of a tool*	X		X
Select diagrams*	X	X	X
X = Improvement * = Overall Improvement (p < .05)			

In every case where an overall improvement was noted, at least two of the three individual classes showed a significant improvement. This would indicate that no specific class significantly biased overall results by extreme scores.

Several factors were considered to explain the lack of improvement in areas by all classes. Student apathy toward taking the post-test was considered as a possible reason for the lower scores; however, improved scores in later test sections did not support that assertion. The lack of improvement was not due to different instructors since the same instructors were used for each course offering.

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Discussions with one of the course facilitators
indicated no departures from teaching methods for any of the
classes. However, one unique aspect of the June class
involved the training environment. Both the May and June
classes were held in a renovated school building that used
loud and less efficient window air conditioners. For the
May class, the distractions were minimized by cooler
weather. However, for the June class, the facilitator
identified these window units as distracting during
presentations and resulting in a warmer training
environment. The results of the June class scores may be
partially a result of this environment, but this possibility
cannot be substantiated with the data provided.

Overall, since there was no significant change in score
($p < .05$), the lack of improvement should not be contributed
(necessarily) to teaching methods, testing methods, or
environment. However all of these issues should be
investigated when considering a means to increase and
measure learning in these areas.

Of the thirty improvements possible (all three classes
in each of ten questions sets) for those meeting the
normality criteria, twenty-one improvements were noted.
Twelve of these improvements occurred in the section
covering the problem solving tools and techniques presented
in the course. Since they represent a large portion of both
the course and test material, their results are broken out
separately.

Tools and Techniques Results. Twenty-two of the 56
questions involved the use of problem solving tools and
techniques. To provide insight into the learning of this
specific material, the associated questions were re-scored
by the type of tool or technique. The overall and
individual class results are provided in Tables 6 and 7,
respectively.

Table 6
Tools and Techniques Results -- Overall

Tool or Technique	No. of Questions	Mean Score	Prob>|T|
Total Score	22	4.98	0.00
Brainstorming	2	0.04	0.56
Nominal Group Tech	2	0.34	0.01
Cause and Effect	2	0.95	0.00
Pareto Analysis	3	1.16	0.00
Check Sheets	4	0.91	0.00
Flow Charting	2	0.09	0.35
Solution Sel Matrix	2	0.32	0.04
Force Field Diagrams	3	1.20	0.00
Action Plans	2	0.39	0.00

Wilk-Shapiro statistics were computed for these
variables to ensure the normality assumption was proper.
Values in excess of .70 were noted for all variables making
the use of a paired t-test valid in all cases.

The total score was provided by combining the twenty-
two associated tools and techniques questions. Table 6

Table 7
Tools and Technique Results - Per Class

Tool or Technique	Improved Score (P<.05)		
	Apr	May	Jun
Total Score*	X	X	X
Brainstorming			
Nominal Group Tech*	X		
Cause and Effect*	X	X	X
Pareto Analysis*	X	X	X
Check Sheets*		X	
Flow Charting			
Solution Sel Matrix*		X	
Force Field Diagrams*	X	X	
Action Plans*	X		
X = Improvement * = Overall Improvement (p < .05)			

shows that the average improvement from the pre-test to post-test was 4.98 questions per student (23%). This indicates a significant improvement in scores relating to this material (p < .05). Of the ten tools and techniques involved, only two, brainstorming and flow charting, did not show a significant improvement after training.

Brainstorming and flow charting also represented the only two tools or techniques where none of the three classes showed any significant improvement. While the lack of overall improvement for training material described earlier (Types of Data and Use of Tools) is partially explained by the decrease in scoring by individual classes, this condition is not apparent here. However, it is noteworthy

that brainstorming and flow charting both represent the highest pre-test scores for any tool or technique as shown in Table 8.

Table 8
Tools and Techniques Ranked Pre-test Results

Tool or Technique	Pre-test score	No. of Questions	Avg
Brainstorming	1.68	2	84%
Flow Charting	1.50	2	75%
Action Planning	1.20	2	60%
Nominal Group Tech	1.18	2	59%
Solution Sel Matrix	0.93	2	47%
Pareto Analysis	1.23	3	41%
Check Sheets	1.45	4	36%
Force Field Diagrams	0.95	3	32%
Cause and Effect	0.57	2	29%

This means that a very large increase was needed in an already good score to show a statistically significant improvement. Since two questions were associated with brainstorming and flow charting, the concern over a limited number of categories in the discrete distribution is less of an issue here than with the variables for SDI and leadership. The limited number of categories does pose a slight problem, but it seems it is compounded by the high pre-test scores for both variables.

The June class showed the smallest improvement (3 out of 10 topics) of any of the three classes. As described

earlier, a noisy and less comfortable classroom environment was present and may have contributed to the lower scores.

Conclusion. Tables 5 and 7 provide good summary charts for training material and tools and techniques performance results. Those areas where improvement is statistically significant represent topics where knowledge appears to be increased by training. Areas where no significant improvement is noted represent topics that facilitators can focus on to improve course effectiveness. No conclusions were drawn from the data concerning SDI, since it failed to meet the criteria for assuming a normal distribution.

The ranked pre-test results provided in Table 8 indicated that the highest level of competence for tools and techniques prior to training were in brainstorming and flow charting. Students did very well initially in these two areas and did much worse in other areas that may need more emphasis in the future.

Investigative Question 3

Are the following antecedent variables significant predictors of a student's performance in the knowledge pre-test (Y)?

    X1.   Involvement in previous CATs (Experience)
    X2.   Previous problem solving/team dynamics
          training (Training)
    X3.   Education Level (Education)

A general linear regression model was developed from these three predictors involving training, experience, and education. Experience ranged from no involvement to involvement in three or more CATs. The training predictor

was based on how the participant answered 5 items relating to past training that addressed current course material. Education level was scaled on the highest degree received to date ranging from high school diploma to a doctoral degree.

To measure predictive capability, the all-ways regression procedure was used to allow variables with a 0.05 significance level entry into the model.

Model aptness was tested by several factors that were identified in the regression model discussion in Chapter 4. Testing of residuals indicated a normal random distribution (Wilk-Shapiro = 0.95) with a mean of zero and no trends with respect to predictors. As shown in Table 9, multicollinearity was not a problem since none of the predictor variables exhibited a very high correlation with other variables.

Table 9
Correlation of Pre-test Predictor Variables

Variable	Degree	Training	CAT Involvement
Degree	1	.413	.278
Training	.413	1	.113
CAT Involvement	.278	.113	1

Since aptness tests regarding residuals indicated no deviation from model requirements, the regression analysis using the pre-test score as the dependant variable was performed. Results are shown in Table 10 and indicate that the independent variables for education (degree) and

previous training (training) were significant predictors while previous CAT involvement (experience) was not a significant predictor (P < .05).

Table 10
Summary of the Regression Model

Variable	Partial R^2	Model R^2	Prob>F
Degree	0.09	0.09	0.04
Training	0.11	0.20	0.02

Conclusion. While the variables for training and degree are significant predictors, the overall R^2 value for the model including these two variables is .20, indicating it can only account for 20% of all the variance found in the scores. Previous CAT involvement is not a significant predictor. As a result, past training and education may be useful in a more comprehensive model, but alone provide limited explanatory power in predicting an individuals pre-test score.

Investigative Question 4

Is there an overall increase in self-efficacy in the application of course material as a result of attending CAT leader training?

As part of both the pre-test and post-test, each student was asked to rate their ability to perform various tasks related to the application of CAT leader training material. These tasks included having the capability to: lead a group through the problem solving process, explain

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the TQ structure and philosophy, use the tools and techniques of problem solving, prepare and facilitate an effective meeting, and understand the subject of group dynamics enough to build an effective team.

Since all five relate to training material, the scores from a seven-point Likert scale of each were combined to provide an overall self-efficacy rating. Wilk-Shapiro statistics on the related variables indicated approximately normal distributions which allowed the use of the paired t-test for comparison. These scores are provided in Table 11.

Table 11
Self Efficacy Results - Per Class

Group	Pre-test Score	Change	Prob>$|T|$	Improved
Overall	17.5	5.72	0.00	X
April	17.8	6.19	0.00	X
May	17.0	7.50	0.00	X
June	18.0	2.54	0.45	

An increase in self-efficacy relating to the training material is observed across all three classes. A paired t-test shows that the overall score and the classes tested in April and May increased their self-efficacy score significantly. The June class showed less than a significant improvement in this area.

Comparison of the pre-test scores rules out the possibility that the June class had a significantly higher

score which left little room for improvement. On the contrary, the June class had only a slightly higher score but showed a significantly lower improvement in the post-test.

This finding also correlates with the absolute decrease in scoring for test items involving types of data and use of tools. As discussed earlier in the overall results broken down by class, the June class' warmer and noisier training environment was the only area specifically identified by one of the course facilitators that seemed different from the other two classes. However, since this class did exhibit some improved scores in certain areas, environment does not seem to have had a detrimental impact in all data measurements. As a result, the training environment can be considered as a possible influence on test scores and self-efficacy ratings, but data does not support it as the only factor that may explain the variance between classes.

Individual Subject Self-Efficacy Scores. The five tasks that were used to provide the overall self-efficacy score were broken out to investigate any trends in this data for the combined group of three classes. Normality requirements were met in these areas which allowed paired t-test to be performed. Table 12 provides the self-efficacy scores by task.

Results indicated that in four of the 5 individual tasks, the overall group showed a significant improvement. The remaining task (leading a group through the problem

Table 12
Individual Task Self-efficacy Results - Overall

Self-efficacy Subject	Pre-test Mean	Mean Change	Prob>¡T¡
Overall	17.54	5.72	0.00
Lead a group	4.34	0.45	0.06
Explain TQ	3.11	1.34	0.00
Use tools and techniques	3.50	1.02	0.00
Run an effective meeting	3.50	1.11	0.00
Build an effective team	3.07	1.60	0.00

solving process), while not showing a significant improvement, did have the highest pre-test score.

Conclusion. Overall improvement in self-efficacy for two of the 3 classes was large enough to indicate a significant improvement for the entire group. Investigation of individual task self-efficacy showed an improvement in four of the five task scores showing that a large portion of the course improves the students' perception of their capability to perform specific tasks.

Investigative Question 5

Are a significant number of CAT leaders assigned CAT issues within three months of training?

Investigative question five begins the field evaluation portion of the research by looking at data relating to the past course participants. Of the 208 responses to the questionnaire, 56 past attendees indicated that they have served as a CAT leader since training. These individuals are the focus of this investigative question.

To determine whether the majority of CAT leaders are assigned a CAT issues soon after training, those who indicated they have served as a CAT leader since training were asked to identify the time gap between training and being assigned a CAT issue. Table 13 identifies the frequency of responses by those surveyed.

Table 13
Gap Between Training and CAT Leader Assignment

CAT assigned prior to training	12
Cat assigned 0 - 1 months after training	12
CAT assigned 2 - 3 months after training	14
CAT assigned 4 - 6 months after training	13
CAT assigned 7 - 12 months after training	4
CAT assigned over 1 year after training	1

A chi-square test was preformed to determine if the responses followed a homogeneous distribution. Three groups were formed by combining the first three and the last two categories to test whether a significant number of CAT leaders were assigned issues within three months of training. Combining the first three categories was required because they represented the time period of less than three months. The last two categories were combined to meet the requirement of having at least five responses in each category to obtain a valid chi-square statistic.

Results yielded a chi-square statistic of 7.14 which was sufficiently large to reject the homogeneous

distribution test (P < .05). This indicated that, of those receiving CAT assignments, a significant number of CAT leaders were assigned CATs within three months of training.

Further review of the data showed almost a homogeneous distribution over the first four categories. To determine if the training gap supported this observation, another chi-square test was performed. This time the last three categories were combined to represent those leaders who were assigned a CAT four or more months after training. Results yielded a chi-square statistic of 1.72 which was sufficiently small enough not to reject the homogeneous distribution hypothesis (p < .05).

Conclusion. A significant number of those training participants who become CAT leaders are assigned a CAT issue within three months of training. Additionally, the underlying distribution describing the time interval of assignments follows a homogeneous distribution where one quarter of the assignments are made in each of the following categories: before training, within a month of training, between two and three months after training, and over four months after training.

Investigative Question 6

Are there a significant number of training participants becoming members of CATs?

CAT leader training was designed to support the total quality initiatives in Aeronautical Systems Division. However, the concepts, tools and techniques of the training

are useful in many organizational situations. This has encouraged the attendance of individuals who do not plan on being a CAT leader, but wish to improve their problem solving skills. Investigative question 6 addresses the issue of CAT participation by past course participants.

Of the 208 respondents to the questionnaire, 116 (57%) indicated that they have not been involved as either a leader or participant in a corrective action team. Of those participating in CATs, 57 have been involved in only one, 19 have been involved in two, and thirteen have been involved in three or more.

A chi-square test was performed to determine if a significant number of training participants became involved with corrective action teams. Those who have not participated represented one category and those who were involved represented a second category. Results yielded a chi-square statistic of 3.56 which was small enough to indicate an even distribution of past participants that both do and do not get involved in CATs after training.

Conclusion. A significant number of training participants do not become members of CATs after the training is completed. The number who do get involved is approximately the same number as those who do not get involved.

Investigative Question 7

Is there a noticeable decline in self-efficacy regarding application of training material as time since training increases?

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This question involves investigating the self-efficacy score trend of each training group with respect to the length of time between responding to the questionnaire and attending CAT leader training. Even though samples were independent making longitudinal tests impossible with the one-shot case study format, review of self-efficacy scores between groups was accomplished to identify any possible time related trends.

Between Training Groups. A two sample t-test approach was used to determine if the scores varied significantly from one group of classes to the next. To increase the size of each sample and investigate longer term time trend results, the twenty-one classes were combined chronologically into seven training groups. Each group contained three classes. The class dates, group size, self-efficacy means and standard errors for each group are identified in Table 14.

A two-sample t-test was performed on every combination of group scores to determine if there was a noticeable decline in self-efficacy with an increase in time since training. Results of all combinations, showed that only the comparison between groups 2 and 5 indicated a significant difference in mean scores (p < .05). Visual inspection of Table 14 confirms this result since these two self-efficacy scores showed the widest variation between all groups.

Investigating trends between training groups provides an indication that there is not a significant decrease in

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Table 14
Training Group Self-efficacy Scores

Group	Training dates (final day)	N	Self-efficacy Score Mean	Std Error
1	1 Sep 1989 29 Sep 1989 13 Oct 1989	30	24.4	1.10
2	17 Nov 1989 8 Dec 1989 12 Jan 1990	27	25.8	0.83
3	9 Feb 1990 9 Mar 1990 6 Apr 1990	34	22.5	2.05
4	4 May 1990 8 Jun 1990 13 Jul 1990	30	25.1	1.13
5	20 Jul 1990 10 Aug 1990 14 Sep 1990	32	20.8	1.66
6	12 Oct 1990 16 Nov 1990 7 Dec 1990	18	23.1	1.71
7	8 Feb 1991 22 Mar 1991 12 Apr 1991	39	23.7	0.62

self-efficacy over a time period of several months, but it does not address the change in self-efficacy that occurs immediately after training. The investigation of training classes was briefly considered to examine this issue. However, scores between classes had so much variation, that comparisons between separate classes was inappropriate. A longitudinal study of the same class over time is recommended to investigate short term self-efficacy changes.

Conclusion. Data does not show that self-efficacy exhibits a significant trend between classes as the time

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since training increases. The large range of self-efficacy scores and the lack of longitudinal data for a specific class do not permit any conclusions for short term or intra-group score impacts resulting from time.

Investigative Question 8

Are problem solving tools and techniques being used in the organizational and CAT environments?

In Chapter 3, the application of learning was emphasized as the reason for the training provided. Since the problem solving steps and the related tools and techniques constitute a large portion of the CAT leader training program, specific emphasis is being placed on whether these tools are being applied after training has occurred. The steps of problem solving were considered a tool or technique for this section of the research.

Overall Level of Use. Section 5 of the questionnaire involved the application of tools and techniques. Items involving the levels of use constituted the first portion of this section. Respondents were requested to note the level of use of the problem solving tools and techniques provided in the course. A summary version five-point Likert scale used to measure responses in the questionnaire is identified in Figure 8.

Table 15 identifies the frequency of responses, in both the CAT and organizational environment, for each of the 10 problem solving items. Categories of use correspond with the Likert scale identified in Figure 8, except that the CAT

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┌─────────────────────────────────────────────────────────────┐
│ 1.  Have not used personally and have not seen used          │
│ 2.  Have seen used in a CAT setting                          │
│ 3.  Have seen used in an organization setting                │
│ 4.  Have personally used in a CAT setting                    │
│ 5.  Have personally used in an organization setting          │
└─────────────────────────────────────────────────────────────┘
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Figure 8.   Likert Scale to Measure Level of Use of Tools
            and Techniques

and organizational environment categories were combined to
limit the data to three categories (not used, seen used, and
personally used).

Table 15
Frequency of Responses Regarding Overall Level of Use

Tool or Technique	Not Used	Seen Used	Personally Used
Problem Solving Steps	31	44	124
Brainstorming	8	20	171
NGT	54	47	95
Cause and Effect	103	52	41
Pareto Analysis	87	66	44
Check Sheets	97	51	53
Flow Charting	33	58	105
Solution Sel Matrix	116	48	31
Force Field Analysis	127	41	34
Action Planning	64	45	94

A chi-square test for goodness of fit was performed on
all topics to determine if the responses followed a
homogeneous distribution.   In every case, that hypothesis
was rejected because of a disproportionate number of

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responses in a specific category (p < .05). These large

response categories represented two extremes. The first

involved five items where a significant number of

respondents indicated they had not seen the tool or

technique used at all. The second extreme involved the

other five items where a significant number of respondents

indicated they had personally used the tool or technique.

There was no case where the largest response concerned

seeing a tool or technique used, but not using it

personally.

Table 16 identifies those topics where "no use" was the

most significant category noted by the respondents. Force

field analysis was identified as the least used of all the

topics discussed where 63% of the respondents stated that

they have never seen or used force field analysis in either

a CAT or organization setting. The other topics included:

cause and effect analysis, pareto analysis, and the solution

selection matrix.

Table 16
Largest Category - Tool or Technique Not Used

Tool or Technique	Number	% of total	Chi-square
Force Field Analysis	127	63%	79.7
Solution Selection Matrix	116	59%	62.3
Cause and Effect Analysis	103	53%	33.5
Check Sheets	97	48%	20.2
Pareto Analysis	87	44%	14.1

Table 17 identifies those topics where "personal use" was the most significant category noted by respondents. Brainstorming was identified as the most used of all topics addressed. 86% of the respondents stated that they have personally used brainstorming in either the CAT or organizational setting. The other topics personally used by a significant number of those surveyed included: steps in problem solving, nominal group technique, flow diagrams, and action planning.

Table 17
Largest Category - Tool or Technique Used

Tool or Technique	Number	% of total	Chi-square
Brainstorming	171	86%	248.8
Steps in Problem Solving	124	62%	76.5
Flow Diagrams	105	54%	40.9
Nominal Group Technique	95	48%	20.6
Action Planning	94	46%	18.0

Conclusion. Results indicate that of the ten topics that respondents addressed, half did not see a significant amount of use outside of the classroom, while half of them did. As noted earlier, the CAT leader training forum is not the only place where individuals are exposed to the problem solving tools and techniques discussed. But it is designed to promote their continued and effective use. From the data collected, no observation can be provided about the increased use of these tools and techniques that result from

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training, since longitudinal data is not available.

However, the level of current use noted here can provide a

basis for the focus of future course offerings.

<u>Investigative Question 9</u>

Are problem solving tools and techniques perceived as being used frequently in the CAT and organizational environment?

Frequency of use was another item measured as part of

Section 5 of the questionnaire. Respondents were requested

to note the frequency of use over the *last three years* of

each of the problem solving tools. The frequency of use

involved a four point Likert scale that included: never,

once, twice, and three or more times.

Table 18 identifies the frequency of responses for each

of the ten problem solving items of interest.

Table 18
Frequency of Responses Regarding Frequency of Use

Tool or Technique	Never	Once	Twice	Three+
Problem Solving Steps	41	32	28	101
Brainstorming	12	24	18	146
NGT	76	46	24	53
Cause and Effect	128	40	22	13
Pareto Analysis	124	35	17	23
Check Sheets	117	30	18	35
Flow Charting	47	37	36	83
Solution Sel Matrix	149	32	12	10
Force Field Analysis	152	28	16	6
Action Planning	77	33	17	73

A chi-square test for goodness of fit was performed on all topics to determine if the responses followed a homogeneous distribution. In every case, that hypothesis was rejected because of a disproportionate number of responses in a specific category ($p < .05$).

Frequency vs. Level of Use. Comparison of the frequency data with the level of use data showed several trends. As expected, the topics which were not used by a significant number of people, also had a corresponding low frequency of use. Additionally, those topics that were used by a significant number of respondents, also had the highest level of use (three of more times).

Overall Frequency of Use. All topics receive some use in the organizational environment. Even on those topics which are not used by a significant number of individuals, a minimum of 50 people have indicated they have seen the topic used at least once in the organization. As in the discussion regarding level of use, longitudinal data is not available to draw conclusions on the impact of CAT leader training on the use of these tools and techniques in the field. However, this data does show that the tools and techniques are used in ASD.

Recent Use. Since these tools and techniques have been taught for years, one concern involved respondents who indicated they had seen a tools or technique used, but during a time period that preceded CAT leader training. To determine the number who had seen it used recently and

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possibly as a result of CAT leader training (in the last
three years), the size of response of those who have never
seen a tool or technique used outside training was compared
to the size of response of those who had seen no use in the
past three years. The data indicated that a portion of
those who have seen a tool or technique used, had not seen
it used during the past three years. This information is
provided for each tool and technique in Table 19 and is
ordered by the largest percentage of respondents who have
not seen it used recently.

Table 19
Respondents Who Have Not Recently Seen a Topic Used

Tool or Technique	No use	No use in 3 yrs	Change	%[*]
Pareto Analysis	87	124	37	19%
Solution Sel Matrix	116	149	33	17%
Cause and Effect	103	128	25	13%
Force Field Analysis	127	152	25	12%
NGT	54	76	22	11%
Check Sheets	97	117	20	10%
Flow Diagrams	33	47	14	7%
Action Planning	64	77	13	6%
Problem Solving Steps	31	41	10	5%
Brainstorming	8	12	4	2%
* - % computed based on total number of respondents				

Pareto Analysis ranked first out of the topics in the
percentage of individuals who have not seen a specific topic
used in the last three years. Brainstorming was the lowest

topic where almost all individuals exposed to it, have seen it used in the last three years. Since missing data results in different sample sizes for individual questions, percentages were based on the total number of respondents.

Conclusion. In those cases where the level of use was significantly high, a higher frequency of use was noted. Likewise, the least used tools and techniques had the lowest frequency of use. Use of all the tools and techniques have been witnessed by at least 50 individuals indicating that these subjects are being practiced in the field. For those who indicated they had not seen a tool or technique used, the large majority (over 80% in all cases) have seen it used in the last three years. While this corresponds with the with the approximate beginning of CAT leader training, the specific impact of CAT leader training toward use cannot be determined with the case study data.

Investigative Question 10

> Are problem solving tools and techniques perceived as being useful tools for team problem solving?

Now that the level and frequency of use for problem solving tools and techniques has been discussed, the perception of usefulness will be addressed. Respondents were requested to note the usefulness of the topics as tools for team problem solving. The responses involved a five point Likert scale that described items as: very useful, somewhat useful, undecided, rarely useful, and not useful.

Table 20 identifies the frequency of the level of usefulness responses for each of the items of interest.

Table 20
Frequency of Responses Regarding Usefulness

Tool or Technique	1	2	3	4	5
Problem Solving Steps	136	49	12	2	4
Brainstorming	158	34	7	1	4
NGT	74	66	47	10	6
Cause and Effect	29	65	64	24	16
Pareto Analysis	39	69	61	19	10
Check Sheets	40	65	70	15	9
Flow Charting	82	72	30	8	11
Solution Sel Matrix	22	54	93	20	13
Force Field Analysis	27	40	94	22	19
Action Planning	93	48	44	5	8

1=Very useful   2=Somewhat useful   3=Undecided
4=Rarely useful   5=Not useful

A five-point Likert scale was used to develop an interval rating of the degree of usefulness of each item listed. Since the options represented a range of responses possible, a weighted linear transformation was performed to provide a relative scale of usefulness for each item. The scale went from very useful (+2) to not useful (-2) with even intervals of one in between. Table 21 provides those results along with the percentage of respondents who rated the item "rarely useful" or "not useful".

Table 21
Tools and Techniques Transformation Values and Low
Usefulness Response Percentages

Tool or Technique	Rating	Rarely or Not Useful
Brainstorming	1.67	2.5%
Problem Solving	1.53	3.0%
Action Planning	1.08	6.6%
Flow Charting	1.01	9.4%
NGT	0.95	7.9%
Check Sheets	0.56	12.1%
Pareto Analysis	0.55	14.6%
Cause and Effect Analysis	0.34	20.2%
Solution Selection Matrix	0.26	16.3%
Force Field Analysis	0.17	20.3%

All topics had a positive mean indicating that the respondents found some degree of usefulness in every topic. Brainstorming and the steps to problem solving were seen as very useful by the vast majority of those surveyed. Action planning, flow charting, nominal group technique, and pareto were perceived as the next most useful set of tools and techniques. In this group, the majority of respondents rated the items as either very or somewhat useful. Check sheets, cause and effect diagrams, the solution selection matrix, and force field diagrams constituted the remaining items. In three of these four cases, the largest response category was "undecided", indicating that many of those surveyed had not yet formed an opinion on the degree of usefulness for those tools and techniques.

Rarely or Not Useful Ratings. The last column of Table 21 provides the percentage of those surveyed who rated the item as "rarely useful" or "not useful". This data provides insight into the perception of respondents regarding the material provided in the course. Force field analysis and cause and effect diagrams represented items that had the largest number of low ratings. However, in all cases, the majority of respondents rated the tool or technique useful or was at least undecided. This indicates that no tools or technique taught in the course was perceived as inappropriate for use in the organizational environment.

Conclusion. The transformation ratings indicate that all tools and techniques have some degree of usefulness as problem solving tools. While some items (Check sheets, pareto analysis, cause and effect diagrams, the solution selection matrix, and force field analysis), have a large number of "undecided" responses, no item was found to have no use in problem solving.

Investigative Question 11

> Do a significant number of CAT leaders rate the use of
> a CAT as appropriate in addressing the CAT related
> issues assigned?

CATs are often assigned based on the "type" of issue involved. Chapter 2 described three categories that were used to aid in assigning and tracking issues to the appropriate owners and organizations. Type 2 issues involved coordination by several offices in an organization

and normally is a prime candidate for a corrective action team (ASD/TQ, undated:10). This investigative question involves whether the respondents involved with a CAT perceive its use a appropriate in addressing the issue.

Forty-six of the respondents who were participating in a CAT rated it as very applicable for the issue involved, 33 rated it somewhat applicable, 9 rated it as not very applicable, and 6 provided a rating of not applicable. These categories were combined into two groups with very and somewhat applicable making up the first group and not very and not applicable making up the second.

A chi-square test was performed to determine if the frequency of responses for these two groups followed a homogeneous distribution, indicating at least half of the respondents did not see the use of a CAT as appropriate. Results yielded a chi-square statistic of 68.8 which was sufficiently large to reject the homogeneous distribution test.

Conclusion. A significant number a past training participants who have been involved in at least one CAT perceive the use of a CAT as appropriate in addressing the issue assigned.

Questionnaire Written Comments

Section 6 of the questionnaire solicited feedback regarding areas not covered or insufficiently covered by previous items. Respondents were asked to use their

experience as graduates of CAT leader training who are now involved in organizational issues to suggest course changes and improvements.

Nine categories for comments were provided to encourage specific feedback on each facet of the training. These categories included: TQ background, personal values, group dynamics, steps of problem solving, tools and techniques, exercises, movies, final exercise, and other. Sixty-nine of those surveyed provided written comments. Appendix G contains those written comments broken out by topic. The overall comments provided by respondents will first be discussed followed by feedback on specific sections.

Only those comments that have universal application to the current syllabus will be discussed in this chapter. The summaries below are designed to overview the responses made by course graduates. Appendix G represents the source of those summaries.

Overall comments. Fifty-two comments that were classified as overall (or other) were made by respondents. Twenty-four positive overall comments were made in this section compared with four negative. Most positive comments addressed the respondent's agreement on the current course content and delivery. Negative comments involved the lack utilization as a CAT leader training graduate, length of the training (too long), the lack of follow-up, and the need to discuss more ASD related issues.

The main recommendations involved increasing the trained population to include all personnel, developing a refresher course and/or making training more timely, providing periodic surveys to past attendants, and emphasis on team dynamic issues involving conflict and management resistance.

Total Quality Comments. Eighteen comments represented the range of responses on the TQ background section. The majority of those making recommendations indicated that the material needs to be tailored to the individual group. Many recognized the need for information on total quality, but stated that it was redundant for some of the participants. Those with minimal TQ training stated that more of the basics were needed.

Negative comments involved too much time spent on fundamentals. Additionally, some of the material was described as outdated and too narrow in focus since it didn't include more discussion of individuals such as Deming, Crosby, etc.

Personal Values Comments. Of the twelve comments on the personal values section, ten were overwhelmingly positive. Several of those who responded indicated it was helpful both in understanding themselves, and those around them. A recommendation by one past attendee included using the Myers-Briggs Type Indicator as a substitute for the Strength Deployment Inventory.

Group Dynamic Comments. Seven individuals responding with comments on group dynamics were mostly favorable. Several identified the need to spend more time on the subject and include as a stronger focus on what makes a successful team and a recommendation to use role playing in learning to deal with difficult team members.

These comments are supported by the negative content validity ratio (CVR) related to dealing with difficult team members that was discussed in Chapter 4.

Steps of Problem Solving Comments. The smallest group size of six provided comments for problem solving steps. Overall, the comments were positive and two of the six who responded recommended a summary handout of the related material for use as a reference.

Tools and Techniques Comments. Sixteen separate comments were provided for the tools and techniques. Recommendations included focusing on the most used items, updating the manual, and providing more information on the when to use specific tools and techniques. Again, a summary handout was recommended of the material for use as a reference.

Exercise and Movie Comments. Nine individuals responded with comments and suggestions on the use of exercises in the course. The most frequent response involved the need to make the exercises more relevant to the work environment.

Eight responses were provided to the movies category. One respondent thought they were not useful while another indicted they were redundant because he/she had seen some in other training classes. The "Paradigm" film, *Meeting Robbers*, and *The Abilene Paradox* were all specifically referenced as great movies.

Final Exercise Comments. Fifteen comments were collected on the final exercise. Comments mostly involved the need for a more relevant subject. Those with opinions on use of a final exercise to reinforce material learned during the week were positive on that approach. Comments were also made on the time wasted while waiting to collect information from facilitators and the problems associated with being located too closely to other groups.

The written comments provided by those surveyed were generally positive and involved many recommendations that may be used to improve the course. Several individuals provided typed comments to this section indicating the investment of both time and thought in responses.

Summary

Chapter 5 provided a discussion of the data collected from the objectives, the knowledge test, and the questionnaire and formally concludes the requirements of the first five of the six major research objectives. Investigative questions identified in Chapter 1 were addressed and conclusions were drawn for each. In addition,

written questionnaire comments were discussed and summarized at the end of the chapter.

Chapter 6 now addresses the final research objective involving recommendations for improvements to the CAT leader training curriculum based on the information just discussed.

VI. Conclusions and Recommendations

Introduction

The developed objectives, knowledge test results and questionnaire responses provide a basis for a comprehensive study into the effectiveness of CAT leader training. The conclusions and recommendations that follow, are based on a combination of the results in chapter 5 and the experience of the researcher in ASD total quality initiatives and CAT leader training.

A discussion regarding how the six research objectives were addressed is given below. General conclusions are then provided to summarize the study results. Recommendations relating to changes in the current course and follow-on research ideas are then discussed.

Meeting Research Objective Requirements

Chapter 1 identified the six research objectives for the study. These were followed by investigative questions that focused the effort and allowed individual hypothesis to be tested and discussed. The study addressed each research objective. Validating a set of proposed objectives (objective 1) provided a framework for a knowledge test that measured learning and self-efficacy in CAT leader training (objective 2). Identifying the characteristics of current CATs and the involvement of past course attendees was measured by a questionnaire (objective 3). The results of

this questionnaire also addressed both the self-efficacy of past graduates and their perception and application of problem solving tools and techniques (objectives 4 and 5). This chapter now draws conclusions involving the study, and then addresses the final research objective involving recommendations to the Commander of Aeronautical Systems Division (ASD) for improvement of the current CAT leader course (objective 6).

General Conclusions

General results from the evaluation indicate that the training is accomplishing the majority of its desired behavioral objectives and that training related material is being used in by graduates. Below are general conclusions on several aspects of the evaluation.

The Internal Evaluation. Results from the internal evaluation indicate that learning has occurred with the majority of training material presented in the course. Self-efficacy increased in most cases showing an improved self-perception to perform training related tasks. Predictors for a pre-test score model were identified, but provided limited explanatory power to predict a student's pre-score.

Limited focus for the research was placed on the areas of personal values and team dynamics mainly because of the need to limit the scope of study. However, many of the written responses placed a strong emphasis on these subjects

in the course. This points to their strong influence on the
effectiveness of the training and the need for future (and
more thorough) evaluation in this area.

   The Field Evaluation. The field evaluation showed that
most of the CAT leaders are assigned an issue within three
months of training and consider the issues worked relevant
to a group problem solving approach. Half of the ten tools
and techniques taught in training were used by the majority
of graduates, while the other half saw little use. This
result corresponds with the frequency of use for tools and
techniques. All the tools and techniques in the current
curriculum are perceived as having at least some degree of
usefulness by those who responded.

   Only 56 of 208 respondents (27%) have become CAT
leaders in their organizations. This should be a major
concern if the primary goal is to develop trained personnel
for this purpose. Current terminal objectives provided in
the CAT leader notebook support this purpose; however,
recent discussions have disclosed a plan to change the
training title to "Team Leader Training" which would place
less of an emphasis on TQ affiliation (Wissman, 1991).

   The Use of Specific Tools and Techniques. The high
level and frequency of use for several tools, especially
brainstorming and flow diagrams, should be seen as a
positive result shown by this research. However, this
situation may exist because many students have been trained

in these techniques prior to CAT leader training.
Consequently, this training should eliminate or reduce the
emphasis on these techniques. The growth in use for all
tools and techniques should be encouraged, but not mandated.
While some tools and techniques have seen limited use by
graduates of CAT leader training, it does not necessarily
mean that they deserve more use. CAT leader training should
ensuring that they are understood and used properly.

Many tools and techniques are provided in the course so
that options are available to appropriately address a myriad
of organizational issues. However, the study shows that
many students have not demonstrated an ability to identify
the type of data involved (quantitative or qualitative) and
the appropriate tool or technique for a specific problem
solving step. This knowledge is essential for effective
application of the material in a CAT.

Terminal Objectives. The terminal objectives are the
three major objectives currently identified in the CAT
leader notebook. To summarize, they include ensuring
graduates are able to: 1) organize and manage a CAT to
become and remain an effective functioning team, 2) explain
the TQ structure and process effectively, and 3) teach the
problem solving methodology and the appropriate tools and
techniques to CAT members.

The study indicates that students are learning the
material and important methods to develop and run an

effective CAT. However, timeliness of training and the small amount of feedback from graduates, currently limits the ability of training to be even more effective.

Regarding objective 1 that involves organizing and running and effective CAT; only 56 of 208 (27%) respondents to the questionnaire indicated they have performed as a CAT leader. This data shows that the majority of graduates do not fill this role. If developing CAT leaders is a primary objective, then efforts to promote more graduates into these positions is required. This may include educating organizations in their use, modifying the selection criteria for training and perhaps introducing changes in the course format to include even more specific CAT leader exercises and examples.

For the second objective involving explaining the TQ process, the roles and membership of the TQ structure is understood by most individuals. Students have learned the material; however, their ability to synthesize and explain the process represents a higher level of comprehension than that measured in this study.

Finally, the ability of graduates to teach group problem solving and team dynamics material is still an open issue. This study showed that the material was understood via knowledge test results, but a far more complicated measurement is required to demonstrate the ability to teach the material. Indeed, the conclusion that previous CAT

experience is not significantly related to a pre-test score supports the possibility that CAT leaders do not train members to use the problem solving tools. Review of the entire course seems to show a lack of congruency regarding this objective. Class discussions and exercise do not openly support this final objective. The researcher's observation is that students are taught to use the tools and techniques--they are not taught to teach them.

Recommended Changes

Recommended changes are supplied while acknowledging the limitations and advantages of an outside perspective. Clearly, none of the ideas provided should be made without the understanding and concurrence of the course facilitators. These individuals have a wealth of knowledge and experience that cannot be documented within these pages. They are responsible for the successes of the training to date. Recommendations for their consideration are provided below.

Review Course Terminal Objectives. As stated in the general conclusions section, both the first and third terminal objectives are not completely met by the current course. The first objective of training CAT leaders is not met since only 27% of graduates go on to fill that role. The third objective involving the student's ability to teach the material, is not supported by the current training methods. Either the training methods need to be changed, or

the terminal objectives need to be modified. The second terminal objective coincides with the current training program, but should still be reviewed to determine if it remains appropriate. All objectives should be considered with respect of the organizational needs currently present.

Incorporate Training Block Objectives. Training behavioral objectives were developed as part of this research and should be incorporated into the syllabus. These objectives formally describe both the material and level of learning desired by the current syllabus. They communicate expectations to the learner and provide a standard of measurement for training effectiveness (Goldstein, 1984:59).

Changes in course structure and content should consider current emphasis, overall course constraints, and terminal objectives. Clearly, if adding additional material is considered, then a corresponding decrease in the current syllabus or an increase in course length is required. The behavioral objectives provide a guideline to accomplish this task.

Investigate Areas Showing Little Improvement. When reviewing areas to focus improvement from knowledge test data, facilitators should investigate any area where a significant improvement in score was not made by all classes. While unique characteristics exist among each class, different conditions introduced by facilitators may

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have an impact on performance and effectiveness. If this is
the case, then they need to be identified and addressed.

Review Objectives Not Emphasized. Seven of the
proposed objectives had negative content validity ratio
(CVR) scores. This indicates that there is material in the
CAT leader notebook that is not being taught by the majority
of instructors during the class. This would be expected
since the CAT leader notebook holds substantially more
information than can be provided in a four-day course.

All objectives have a CVR score that provides a
relative scale of emphasis by instructors. It would be
useful in reviewing and in determining the desired mix in
course content. A formal decision on any change in
priorities should be discussed and agreed upon by both
facilitators and the course director. Field units and
current CAT leaders should also be queried to identify
current system requirements.

In addition to the use of content validity ratios, the
knowledge test data regarding comprehension of specific
tools and techniques may be useful to identify those
subjects understood by students prior to the class (pre-test
results). This information may allow the facilitators to
de-emphasize some material by providing a summary of the
relative information. This would allow more time for other
areas. The use of the instructional systems development

(ISD) model would be an excellent tool to coordinate this process.

Measure Student Self-Efficacy. The five question scale developed in this research covers the main areas of task transference in the course related to personal use and application. This overall score can be computed for each class to provide an indication of the level of confidence it has in accomplishing course related tasks.

Easily computed averages for each class the first day may provide some indications as to the level of self-confidence of each class, allowing facilitators the ability to tailor their presentations. Additionally, a more quantitative measurement (as opposed to a critique) of training effectiveness could be provided from a pre-test/post-test comparison. Self-efficacy measurements dealing with higher levels of transference (i.e. teaching or explaining) could also be useful in future evaluations.

Results of self-efficacy measurements in the research data indicated that the June class showed the least (if any) improvement. Their corresponding scores in the knowledge test also showed a lower levels of learning, especially related to tools and techniques. These results may be the result of ineffective instruction, improper test measurement constructs, or environmental conditions. Self-efficacy scores related to future test results may provide more insight into this problem.

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<u>Develop a Tools and Technique Workbook</u>. A tools and techniques workbook should be developed. This workbook could provide more work-related examples, an in-depth discussion of data types and collection, and summary information for reference during meetings.

Many of the comments collected by past participants involve the use of problem solving tools and techniques. Specific comments involved knowing when to use a specific item, a desire for more work-related examples, and the need for a summary handout to reference in meetings. These comments and the researcher's review of the current CAT leader notebook support the need for a more comprehensive set of references regarding specific uses of tools and techniques. Additionally, current CAT leaders in ASD organizations would be prime candidates for identifying and developing organizationally related examples.

One final point that supports a tools and techniques workbook involves the application of material. Knowledge test results indicated a lack of understanding between the concepts of qualitative versus quantitative data. This understanding is *critical* to the proper use of tools and techniques and needs to be emphasized more both in class and in reference material.

<u>Investigate Training Format and Improve Follow-up</u>. Comments made by several of the past participants involved the excessive length of training and the need for a

refresher (or follow-up) course for participants.
Currently, time gaps in training often occur for each class
in different areas of the course. Videos and exercises are
used well by facilitators to compensate for the different
needs and schedules of each group. Unfortunately, a four-
day course requires a significant commitment from ASD/TQ
personnel which conflicts with the desire to offer a
refresher (or follow-up) course.

If an objective of CAT leader training is to continue
producing the current number of graduates, then a one week
CAT seminar is recommended for study to address training
length and follow-up. The one-week program would include
two sessions: the first involving initial training, and the
second as a refresher course. The initial training course
would last three days and constitute the majority (but not
all) of the current course emphasis. The second session
would involve specific work issues from ASD. The second
session could include several categories of participants
that include: members of the first session that have
already been assigned a CAT issue, past participants
recently assigned an issue, leaders experiencing problems
with their current CAT, personnel with past experience and
training in the area, and others desiring more exposure to
tools and techniques.

Small groups can provide support in determining
approaches for addressing specific problems and tools and

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techniques to use. Complete CATs may be able to use this time as an off-site to begin their own group with necessary support from roaming facilitators during those two days. Such a program would require a great deal of flexibility from the facilitators, but would address many concerns felt by graduates who have no formal follow-on program. Additionally, it would require only one additional day in a training location (although more time planning).

Follow-on Research

As discussed earlier, this research involved both an internal and a field evaluation of CAT leader training; however, the limited time frame and lack of secondary data limited the scope of the effort. Specifically in the field evaluation, the one shot case-study approach precluded any conclusions about training impacts to the organization. Below are several ideas for follow-on research to build on the body of knowledge already developed and account for limitations in the research.

Study the Current Training Syllabus. This research did not specifically address the appropriateness of the current training syllabus. Course material was assumed to be necessary for training a CAT leader.

One recommended follow-on effort involves the use of the Air Force instructional systems development (ISD) model in reviewing the course from a system requirements perspective. Steps 1 and 2 of the ISD model involves

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analyzing system (organizational) requirements and then defining a training requirement. This has been accomplished for the current program in a less formal way and would be a good basis for validating the current syllabus and identifying necessary changes. The organizations involved in CAT leader training have many unique requirements that may require changes in the focus of CAT leader training and the introduction of additional material. In the April class, the concept of storyboarding was introduced. Perhaps this tool and others could be reviewed for applicability to CAT leader training and appropriately incorporated. The ISD model provides and excellent framework to accomplish this purpose.

Develop a Pre-test Predictor Model. Currently, training is provided to a broad range of personnel with different levels of experience and competence. A goal would be to tailor each course (or provide two or more levels) to meet the needs of individual classes and allow facilitators to proceed at a comfortable pace for all members.

The regression analysis performed indicated that there was a noticeable difference in pre-test scores based on the level of education and past training experience of an individual. However, these predictors are not sufficient to accurately predict an overall score. If future course offerings are planned to tailor course material, then a more comprehensive predictor model is required. Predictors that

include more specific demographic, training, and time relative information are required in the model and could be useful in explaining a larger portion of the score variance.

Perform a Longitudinal Study of Course Performance. The pre-test/post-test data collection was accomplished within three days. Even though the control group indicated no significant impact that resulted from test sensitization, the short time span does not address the retention of material in the time period following the training. Administering the same knowledge test to recent graduates of CAT leader training should provide some insight into this area.

If the knowledge test approach is attempted in the future, recommend that several questions are developed for each variable of interest. Some limitations to this study were the result of only two or three test questions per variable. This limited the discrete distribution categories making it more difficult to approximate the normal distribution.

Perform a Longitudinal Study on Tools and Techniques. The use of a one-shot case study as the questionnaire research design does not provide insight into the culture change involving the use of specific tools and techniques. However, it does provide a basis for future research in this area. Additional data collection from the respondents may show time related trends indicating the use and perceived

usefulness of individual tools and techniques. Since the data from the questionnaire allows grouping by training class, it would be very useful. Also, data collection from the ASD population as a whole, can provide information regarding the perceptions and actions of past course graduates with respect to those not exposed to the training.

Evaluate Other Courses. This research represents the most comprehensive evaluation of a quality related course in ASD. Several other courses provided by ASD/TQ have not received either an internal or field evaluation. Although, these courses have not been reviewed as part of this re earch, many of the work accomplished here may be beneficial to other existing classes. Specific research emphasis recommended for other courses includes developing behavioral objectives, measuring self-efficacy of course related tasks, identifying the level of learning that occurs, and investigating field use and acceptance of course materials.

Appendix A: CAT Leader Training Syllabus

Day 1

    I.   INTRODUCTION. . . . . 8:00 - 12:00
            PURPOSE - EXPECTATIONS
            LEARNING OBJECTIVES
            NORMS
            ADMINISTRIVIA

    II.   OVERVIEW OF TQ
            HISTORY OF TQ IN ASD
            STRUCTURE AND PROCESS OF TQ

    III. PERSONAL VALUES
            PERSONAL VALUES
            MOTIVATION
            PERSONAL STRENGTHS

    LUNCH. 12:00 - 1:00

    IV.   GROUP DYNAMICS. . . . . 1:00 - 4:00
            STAGES IN TEAM FORMATION
            LEADER STYLE
            CONSENSUS DECISION MAKING

Day 2

    REVIEW OF DAY 1

    V.   STEPS IN GROUP PROBLEM SOLVING. . . . 8:00 - 12:00
            OVERVIEW OF STEPS
            OVERVIEW OF TECHNIQUES
            MATRIX

    VI.   SELECT AND DEFINE THE PROBLEM
            BRAINSTORMING
            NOMINAL GROUP TECHNIQUE

    VII. GATHER INFORMATION
            CAUSE AND EFFECT DIAGRAM
            CHECKSHEETS

    LUNCH. 12:00 - 1:00

    VIII. GROUP DYNAMICS. . . . . 1:00 - 4:00
            DATA DISPLAY TECHNIQUES
            PARETO ANALYSIS
            FLOW CHARTING

Day 3

    REVIEW OF DAY 2

    IX. EVALUATE ALTERNATE SOLUTION. . . . . 8:00 - 12:00
           SOLUTION SELECTION MATRIX

    X. PLAN THE IMPLEMENTATION
           FORCE FIELD ANALYSIS
           ACTION PLANNING

    XI. IMPLEMENT THE SOLUTION
           LONG TERM MEASUREMENT

    LUNCH. . . . . 12:00 - 1:00

    XII. MEETING EFFECTIVENESS . . . . 1:00 - 4:00
           MEETING ROBBERS
           MANAGEMENT PRESENTATIONS

    XIII. ISSUES AND ANSWERS

    XIV. PREPARATION FOR APPLICATION DAY

Day 4

    XV. TEST OF FIRE (FINAL EXERCISE)

Appendix B: CAT Leader Training Proposed Objectives

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AERONAUTICAL SYSTEMS DIVISION (AFSC)
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433-6503

REPLY TO
ATTN OF   APIT/LSG (Captain Streitmater)   25 Mar 91

SUBJECT   Evaluation of Corrective Action Team (CAT) Leader Training

TO   CAT Leader Training Facilitators

I am currently evaluating the CAT leader training provided by ASD. Part of this
evaluation involves the development of a knowledge test for the course and a
survey of past attendees. The knowledge test is designed to identify a
participant's mastery of course objectives through examining what they knew
before the course and what they learned as a result of the course. The survey
is designed to identify how course material is used in the organizational
environment. Both tools will be useful in making future course improvements.

A set of validated objectives is required to ensure the development of a
reliable knowledge test and survey. Because of the different training
approaches of each facilitator, your review is required to ensure these
objectives are applicable to the course. Some objectives may only relate to
material in the CAT leader notebook, but your participation is necessary to see
what is addressed in the discussions. You do not need to identify yourself
since only group statistics are required.

Please read the instructions and return the completed package to the TQ office
NLT 28 Mar 1991. My goal is to have a knowledge test prepared for the April CAT
training course. If you have any comments or concerns regarding the attached
objectives, please identify them in the space following the objectives. Thank
you for your time.

KIRK J. STREITMATER, Capt, USAF

5   Atch
1.   Instructions
2.   List of Objectives
3.   APIT Form 11C
4.   List of Definitions
5.   Return envelope

Attachment 1: Instructions

1. Review each of the attached objectives (Attachment 2) and provide the response on the AFIT Form 11C that is most applicable to the way you normally facilitate the course. Use the scope definitions below to gauge the knowledge level required for each objective.

Scope Definitions

The following statements identify the scope of required knowledge proposed to each objective and relate specifically to developing questions for the knowledge test.

Have an appreciation for:

Be exposed to a concept, but not required to recount it.

Identify:

Have the ability to select the answer from a group of options, or properly order a list of items.

Know:

Have the ability to properly describe a process or provide a definition.

2. After responding to each objective using the AFIT Form 11C, follow directions for Sections 2, 3, and 4 on the last page of List of Objectives (Attachment 2).

3. Make any comments regarding definitions on the list of definitions provided.

4. Return the response sheets and list of definitions using the pre-addressed return envelope no later than 28 March 1991.

Note: The objectives developed are meant to describe the current training course as identified by the training syllabus and CAT leader notebook. Some objectives may only relate to material that is never openly discussed in the course but is provided in the book. Specific recommendations for improvements or additional objectives that have not been addressed can be identified on the last page of the list of objectives.

Identify the extent to which you cover each of the objectives below in
your presentations of a particular training block.

    (1) I completely cover this objective
    (2) I partially cover this objective
    (3) I do not cover this objective

    (4) I have never taught this section of the course

Block: Overview of Total Quality Management

1. Identify the four major sub-systems that make up an   (1) (2) (3) (4)
organizations TQ structure from a TQ structure chart.

2. Identify the primary role of the four major sub-systems in an   (1) (2) (3) (4)
organizations TQ structure.

3. Identify the membership of the four major sub-systems that   (1) (2) (3) (4)
make up an organizations TQ structure from a list of options.

4. Identify the expected life of the four major sub-systems that   (1) (2) (3) (4)
make up an organizations TQ structure from a list of options.

Block: Values

5. Have an appreciation for the importance of values in day to   (1) (2) (3) (4)
day interactions that relate to both work and social environment.

6. Have an appreciation for the difference between maintenance   (1) (2) (3) (4)
factors and motivational factors identified by Herzberg.

7. Have an appreciation for what the Strength Deployment   (1) (2) (3) (4)
Inventory (SDI) describes and depicts.

8. Identify that the Strength Deployment Inventory (SDI) is   (1) (2) (3) (4)
based on personal inputs.

Block: Group Dynamics

9. Identify the 5 stages in Tuckman's model for group   (1) (2) (3) (4)
development.

10. Identify the characteristics of each stage in Tuckman's model (1) (2) (3) (4)
for group development.

11. Identify the functions of a leader.   (1) (2) (3) (4)

12. Have an appreciation for what does and does not constitute a   (1) (2) (3) (4)
leader.

Identify the extent to which you cover each of the objectives below in your presentations of a particular training block.

    (1) I completely cover this objective
    (2) I partially cover this objective
    (3) I do not cover this objective

    (4) I have never taught this section of the course

13. Have an appreciation for team characteristics.   (1) (2) (3) (4)

14. Have an appreciation for on-going team assessment.   (1) (2) (3) (4)

15. Have an appreciation for goals of work teams.   (1) (2) (3) (4)

16. Have an appreciation for team norms.   (1) (2) (3) (4)

17. Have an appreciation for problems that teams may encounter.   (1) (2) (3) (4)

18. Have an appreciation for behaviors that indicate a motivational problem in a team.   (1) (2) (3) (4)

19. Have an appreciation for characteristics of effective teams.   (1) (2) (3) (4)

20. Have an appreciation for aids for creating a conducive environment for team effectiveness.   (1) (2) (3) (4)

21. Have an appreciation for the need and timing of consensus decision making.   (1) (2) (3) (4)

22. Have an appreciation for the role of constructive conflict in discussions.   (1) (2) (3) (4)

23. Have an appreciation for the strategies for managing difficult people developed by Manning and Haddock.   (1) (2) (3) (4)

24. Identify some barriers to effective communication.   (1) (2) (3) (4)

25. Identify the responsibilities of the speaker and listener in a conversation.   (1) (2) (3) (4)

26. Know the principles for giving and receiving feedback.   (1) (2) (3) (4)

Block: Problem Solving

27. Have an appreciation for the definition and principles of problem solving.   (1) (2) (3) (4)

28. Identify the steps in the problem solving process.   (1) (2) (3) (4)

29. Have an appreciation for problem statements, objectives and tasks involved in problem definition.   (1) (2) (3) (4)

Identify the extent to which you cover each of the objectives below in
your presentations of a particular training block.

      (1) I completely cover this objective
      (2) I partially cover this objective
      (3) I do not cover this objective

      (4) I have never taught this section of the course

30. Have an appreciation for the tools associated with problem (1) (2) (3) (4)
definition.

31. Have an appreciation for why data is collected and the (1) (2) (3) (4)
difficulties often involved.

32. Identify the differences between qualitative and quantitative (1) (2) (3) (4)
data.

33. Have an appreciation for the tasks and tools associated with (1) (2) (3) (4)
gathering information.

34. Have an appreciation for the objectives of problem analysis. (1) (2) (3) (4)

35. Have an appreciation for the tasks and tools that can be (1) (2) (3) (4)
associated with problem analysis.

36. Identify problem analysis tools as they relate to (1) (2) (3) (4)
quantitative and qualitative data.

37. Identify problem analysis tools as they relate to data (1) (2) (3) (4)
gathering and analysis.

38. Have an appreciation for the objectives in evaluating (1) (2) (3) (4)
alternate solutions.

39. Have an appreciation for the tasks and tools that can be (1) (2) (3) (4)
associated with evaluating alternate solutions.

40. Have an appreciation for the role objectives play in planning (1) (2) (3) (4)
to implement a solution.

41. Have an appreciation for the tasks and tools that can be (1) (2) (3) (4)
associated with planning to implement a solution.

42. Have an appreciation for the objective and concerns in (1) (2) (3) (4)
planning to implement a solution.

43. Have an appreciation for the tasks and tools that can be (1) (2) (3) (4)
associated with implementing a solution.

Identify the extent to which you cover each of the objectives below in your presentations of a particular training block.

> (1) I completely cover this objective
> (2) I partially cover this objective
> (3) I do not cover this objective
>
> (4) I have never taught this section of the course

Block: Tools and Techniques

44. Identify the operational definition of brainstorming.   (1) (2) (3) (4)

45. Identify the operational definition of Nominal Group   (1) (2) (3) (4)
Technique (NGT).

46. Identify the operational definition of Cause and Effect   (1) (2) (3) (4)
Analysis.

47. Identify the operational definition of Check Sheets.   (1) (2) (3) (4)

48. Identify the operational definition of Pareto Analysis.   (1) (2) (3) (4)

49. Identify the operational definition of Flow Charting.   (1) (2) (3) (4)

50. Identify the operational definition of Solution Selection   (1) (2) (3) (4)
Matrix.

51. Identify the operational definition of Force Field Analysis. (1) (2) (3) (4)

52. Identify the operational definition of Action Planning.   (1) (2) (3) (4)

53. Identify how a specific tool or technique may be used in the (1) (2) (3) (4)
problem solving process.

54. Identify a tool or technique when presented with the steps of (1) (2) (3) (4)
that tool or technique.

55. Identify a diagram in the CAT leader notebook which   (1) (2) (3) (4)
represents a Cause and Effect diagram.

56. Identify a diagram in the CAT leader notebook which   (1) (2) (3) (4)
represents a flow chart.

57. Identify a diagram in the CAT leader notebook which   (1) (2) (3) (4)
represents a Source Selection Matrix.

58. Identify a diagram in the CAT leader notebook which   (1) (2) (3) (4)
represents a Pareto chart.

59. Identify a diagram in the CAT leader notebook which   (1) (2) (3) (4)
represents a Check Sheet.

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Identify the extent to which you cover each of the objectives below in your presentations of a particular training block.

> (1) I completely cover this objective
> (2) I partially cover this objective
> (3) I do not cover this objective
>
> (4) I have never taught this section of the course

60. Identify the diagram in the CAT leader notebook which represents a Force Field Diagram.   (1)   (2)   (3)   (4)

Block: Meeting Effectiveness

61. Have an appreciation for the requirements of holding an effective meeting.   (1)   (2)   (3)   (4)

62. Have an appreciation for the requirements in making an effective management presentation.   (1)   (2)   (3)   (4)

This concludes the objectives in Section 1

Section 2

Please circle all objectives in Section 1 that are not always addressed solely due to time constraints.

ex. (64.) Have an appreciation for...

Section 3

If you responded with a 3 or 4 for any objective, please briefly indicate the rationale for that response by that objective in section 1 (i.e. not relevent, uncomfortable with topic, never enough time, etc.).

Section 4

Are there any comments regarding these objectives or are there subjects that were missed? If so, please elaborate (use back if necessary).

Attachment 4: List of Definitions

Brainstorming - Verbal generation of ideas in a group that they key specific details of a topic through encouraging spontaneous, rapid and creative input. Judgement is deferred.

Nominal Group Technique (NGT) - A method of reaching consensus that is a refinement of brainstorming. It involves the individual written recording of ideas followed by a group discussion that ranks and prioritizes.

Cause and Effect Diagrams -A graphical refinement of brainstorming designed to help identify the root causes of a problem. Individuals propose causes to a problem that are graphically represented as branches or twigs that feed into the problem.

Checksheets - A method of accumulating and documenting data to assist in the detection of patterns or frequency of occurrence of events.

Pareto Analysis - A prioritization tool involving a graphical technique where data is arranged in descending order to rank the contributors to a problem by their order of importance.

Flow Charting - A pictorial representation of all major sequential steps in a process.

Solution Selection Matrix - A numerically comparative chart that rates each proposed solution with respect to solution selection criteria. The sum of ratings for each solution against the criteria provides a structured method for comparison of solutions.

Force Field Analysis - A graphical technique that identifies the driving and restraining factors that contribute to the current status of a problem. A vertical line represents the current situation and drivers and restrainers are opposed to each other on opposites sides of the line to represent the reason for the current status.

Action Planning - A written plan of action for accomplishing a stated goal. It includes specific objectives, required major activities, personnel assignments and responsibilities, and an established schedule for accomplishment.

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Obj	Essential Rating	Number of Raters	CVR	Standard (p < .05)	
1	6	9	0.33	0.78	
2	6	9	0.33	0.78	
3	6	9	0.33	0.78	
4	3	9	-0.33	0.78	
5	6	7	0.71	0.99	
6	2	7	-0.43	0.99	
7	7	7	1.00	0.99	
8	7	7	1.00	0.99	
9	9	9	1.00	0.78	
10	8	9	0.78	0.78	
11	6	9	0.33	0.78	
12	6	9	0.33	0.78	
13	9	9	1.00	0.78	
14	8	9	0.78	0.78	
15	9	9	1.00	0.78	x
16	9	9	1.00	0.78	x
17	7	9	0.56	0.78	x
18	6	9	0.33	0.78	x
19	8	9	0.78	0.78	
20	5	9	0.11	0.78	
21	8	9	0.78	0.78	x
22	7	9	0.56	0.78	x
23	2	8	-0.50	0.75	x
24	4	9	-0.11	0.78	x
25	4	8	0.00	0.75	
26	3	8	-0.25	0.75	x
27	8	9	0.78	0.78	
28	9	9	1.00	0.78	x
29	9	9	1.00	0.78	x
30	9	9	1.00	0.78	x
31	9	9	1.00	0.78	x
32	8	9	0.78	0.78	x
33	9	9	1.00	0.78	x
34	9	9	1.00	0.78	x
35	9	9	1.00	0.78	x

Obj	Essential Rating	Number of Raters	CVR	Standard (p < .05)	
36	8	8	1.00	0.78	x
37	9	9	1.00	0.78	x
38	9	9	1.00	0.78	x
39	8	9	0.78	0.78	x
40	6	9	0.33	0.78	
41	8	9	0.78	0.78	x
42	9	9	1.00	0.78	x
43	8	9	0.78	0.78	x
44	8	9	0.78	0.78	x
45	9	9	1.00	0.78	x
46	9	9	1.00	0.75	x
47	8	8	1.00	0.75	x
48	9	9	1.00	0.78	x
49	8	8	1.00	0.78	x
50	7	8	0.75	0.78	
51	9	9	1.00	0.75	x
52	7	9	0.56	0.78	
53	9	9	1.00	0.78	x
54	7	8	0.75	0.75	
55	6	9	0.33	0.78	
56	5	9	0.11	0.78	
57	4	9	-0.11	0.78	
58	5	9	0.11	0.78	
59	5	9	0.11	0.78	
60	4	9	-0.11	0.78	
61	9	9	1.00	0.78	x
62	6	9	0.33	0.78	

Number of positive CVR's = 55

Content Validity Index (CVI) = 0.73

x = taught by all instructors (p < .05)

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Appendix D: CAT Leader Training Knowledge Test

Corrective Action Team (CAT) Leader Training Evaluation

CAT leader training is currently receiving a major evaluation to introduce improvements into the course. You are one of three classes to support in class measurements.

This portion of the evaluation of CAT leader training is designed to identify the knowledge of course material by participants both <u>before</u> and <u>after</u> training. You do not need to identify yourself since only group statistics will be used.

Results should provide a foundation for:

-tailoring the TQ overview where material is already understood.
-investigating the impact of prior experience, training, and education on course material.
-identifying areas of strength to tailor discussions.
-deleting redundant material.
-emphasizing the proper topics.

The test is divided into two parts. Section 1 addresses demographic issues while section 2 relates to your knowledge of course material. This package covers more information than what is presented during training to measure topics that may be included in the future.

Please follow the instructions below:

1. Note your start time at the bottom of the page.

2. Using a number 2 pencil, mark the response sheet (AFIT Form 11D) to answer the questions in the package provided.

   Answer all questions (unless otherwise directed)

3. Note your finish time at the bottom of this page.

START TIME: _____

FINISH TIME: _____

THANK YOU

Section 1: Personal/organizational

1. If Military, what is your current rank (leave blank if civilian)?

   A. NCO (E-1 to E-5)   D. Captain
   B. NCO (E-6 to E-9)   E. Major
   C. Lieutenant   F. Lt Col/Col

2. If civilian, what is your current grade (leave blank if in military)?

   A. GS-3 thru GS-5   E. GM-13 thru GM-14
   B. GS-6 thru GS-8   F. GM-15
   C. GS-9 thru GS-11   G. Other
   D. GS-12 thru GS-13

3. What was your age at your last birthday?

   A. Under 21   E. 36-40   I. 56 or older
   B. 21-25   F. 40-45
   C. 26-30   G. 46-50
   D. 31-35   H. 51-55

4. What is your gender?

   A. Female   B. Male

5. What is your highest achieved education level?

   A. High School Diploma
   B. Associate's Degree
   C. Bachelor's Degree
   D. Master's Degree
   E. Doctoral Degree

6. Are you currently leading a Corrective Action Team (CAT)?

   A. Yes
   B. No
   C. I am an assistant leader

7. How many CATs or Critical Process Teams (CPTs) have you been involved with (as a leader or participant)?

   A. 0
   B. 1
   C. 2
   D. 3 or more

8. Do you currently have a CAT topic assigned to you by your organization?
   (Note: Leave blank if you are not planning to function as a CAT leader.)

   A. Yes
   B. No
   C. No, but one will be assigned upon my immediate return from training.

Have you received any of the following training/education related to group problem-solving and team dynamics?

9. Initial TQ Team Training with Cumberland   A. Yes   B. No

10. Transition TQ Team Training with ASD/Cumberland   A. Yes   B. No

11. Critical Process Team (CPT) Training with ASD/Cumberland   A. Yes   B. No

12. Quality Leadership Workshop training with Cumberland   A. Yes   B. No

13. AFIT - Quality Circle Facilitator/Leader Course (1979-1990) A. Yes   B. No

14. AFLC - Process Action Team (PAT) Training   A. Yes   B. No

15. ALC - Quality Circle Facilitators Training   A. Yes   B. No

16. Other (please specify) _____   A. Yes   B. No

Use the following rating scale for the next 5 statements to express your own feelings on your ability to perform various tasks.

        A. Means you strongly disagree with the statement
        B. Means you moderately disagree with the statement
        C. Means you slightly disagree with the statement
        D. Means you neither disagree nor agree with the statement
        E. Means you slightly agree with the statement
        F. Means you moderately agree with the statement
        G. Means you strongly agree with the statement

17. I feel I have the capability to lead a group of individuals through the problem-
    solving process to resolve an organizational issue.

18. I feel I have the capability to explain the TQ structure and philosophy to
    individuals in my organization.

19. I feel comfortable using the tools and techniques of problem-solving in a group
    environment to address an organizational issue.

20. i feel I have the capability to prepare and facilitate an effective meeting.

21. I feel I understand the subject of group dynamics enough to build an effective team
    and solve an organizational issue.

Knowledge Evaluation

In the following diagram, match the major sub-systems of a "generic" Total Quality (TQ) structure in an ASD organization.

22. ___ Critical Process Team

23. ___ TQ Team

24. ___ Corrective Action Team

25. ___ Executive Steering Committee
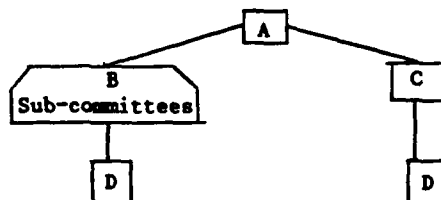
Correctly match the TQ sub-system with its role:

Sub-System	Role
26. ___ Critical Process Team (CPT)	A. Design and implement a system to continuously improve a designated high-level cross divisional/ functional process.
27. ___ TQ Team	
28. ___ Corrective Action Team (CAT)	B. Provide overall planning coordination and guidance of the improvement process. Monitor executive action plans and coordinate labor/ management involvement.
29. ___ Executive Steering Committee	C. Design, implement, and manage a system to cause improvements in an organization.
	D. Address a specific problem in an organization and make recommendations to management for action.

Correctly match the TQ subsystem with its membership:

Subsystem	Membership
30. ___ Critical Process Team	A. Cross functional, high-level executives.
31. ___ TQ Team	B. An entire specially trained team with owners of various elements of a process, plus others
32. ___ Corrective Action Team (CAT)	who would be helpful.
33. ___ Executive Steering Committee	C. Cross section of organizational personnel with varying ranks and grades.
	D. Individuals who are knowledgeable of the problem. Coordination is by a specially trained leader.

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Correctly classify each TQ sub-system as one of the following structures in an organization:

34. ___ Critical Process Team   A. Permanent Organization   B. Temporary Organization

35. ___ TQ Team   A. Permanent Organization   B. Temporary Organization

36. ___ Corrective Action Team   A. Permanent Organization   B. Temporary Organization

37. ___ Exec Steering Committee   A. Permanent Organization   B. Temporary Organization

38. The Strength Deployment Inventory is best described by the following:

   A.   A tool to describe observable behavior and depict general
        orientations/styles based on an individuals self-perception.

   B.   A judgement test of the strengths and weaknesses of an individual.

   C.   A management tool for matching the strength of an individual with
        possible job positions to maximize productivity.

   D.   A group tool where members rate each other on a strength/weakness scale to
        identify possible personality conflicts prior to undertaking a major effort.

Properly order the 5 stages in Tuckman's model of group development:

   39. ___ Stage I   A. Performing
   40. ___ Stage II   B. Norming
   41. ___ Stage III   C. Adjourning
   42. ___ Stage IV   D. Forming
   43. ___ Stage V   E. Storming

Correctly identify the characteristics of the individual stages of Tuckman's model identified below:

        Stage   Characterized by:

   44. ___ Performing   A. Testing and Dependence
   45. ___ Norming   B. Attempts at closure and ending
   46. ___ Adjourning   the team
   47. ___ Forming   C. Development of team cohesion
   48. ___ Storming   D. Intra-team conflict
                               E. Functional Role relatedness

49. Which of the following is not a function of a leader:

   A. Guides a team in delineating a vision and setting goals.
   B. Mobilizes support and resources for goal achievement (helps translate goals into
       actions)
   C. Manages the interaction among members so that the energies of the team remain
       focused on problem solving.
   D. Provides a charismatic role model that encourages resolving group
       conflict and creating an atmosphere to meet common objectives.

50. Which of the following is <u>not</u> a barrier to effective communication:

   A. Expectations
   B. Assumptions
   C. The receiver is a supervisor
   D. The receiver may not be listening
   E. The receiver may not understand

Out of the following list, identify the first 3 steps of the 6 steps of problem solving (order not important):

51. ___   A. Establish the desired goal
52. ___   B. Document the specifics
53. ___   C. Define the problem
                 D. Document a plan of action
                 E. Gather information
                 F. Analyze the problem

Out of the following list, identify the last three steps of the 6 steps of problem solving (order not important):

54. ___   A. Evaluate alternate solutions
55. ___   B. Obtain management buy-in
56. ___   C. Plan the implementation
                 D. Implement the solution
                 E. List solution options
                 F. Document a plan of action

57. Which one of the following lists of tools and techniques is associated with the collection of qualitative data:

   A. Check Sheets and questionnaires
   B. Graphs histograms and Pareto charts
   C. Brainstorming, Interviews and Force Field Analysis

58. Which one of the following lists of tools and techniques is associated with the collection of quantitative data:

   A. Graphs and histograms
   B. Brainstorming and interviews
   C. Nominal Group Technique

59. Out of the following list, identify that item that is <u>not</u> <u>considered</u> quantitative data:

   A. The time to coordinate a letter
   B. The types of priorities in an action plan
   C. The number of clerks in an office
   D. The total cost of a weapon system

60. Out of the following list, identify the item that is <u>not</u> <u>considered</u> qualitative data:

   A. The names of each member of a team
   B. The approval steps in signing out a letter
   C. The factors that are considered in a promotion
   D. The amount of a raise

Match each specific tool or technique with its corresponding operational definition:

61. ___ Cause and Effect   A.   A pictorial representation of all major sequential
        Diagrams   steps in a process.

                          B.   A prioritization tool involving a graphical technique
                                  where data is arranged in descending order to rank the
62. ___ Force Field Analysis   contributors to a problem by their order of
                                  importance.

                          C.   A written plan of action for accomplishing a stated
                                  goal. It includes specific objectives, required major
63. ___ Check Sheets   activities, personnel assignments and
                                  responsibilities, and an established schedule for
                                  accomplishment.

                          D.   Verbal generation of ideas in a group that they key
64. ___ Nominal Group   specific details of a topic through encouraging
        Technique (NGT)   spontaneous, rapid and creative input. Judgement is
                                  deferred.

                          E.   A method of accumulating and documenting data to
65. ___ Flow Charting   assist in the detection of patterns or frequency of
                                  occurrence of events.

                          F.   A graphical technique that identifies the driving and
                                  restraining factors that contribute to the current
66. ___ Solution Selection   status of a problem. A vertical line represents the
        Matrix   current situation and drivers and restrainers are
                                  opposed to each other on opposites sides of the line
                                  to represent the reason for the current status.

67. ___ Action Planning   G.   A graphical refinement of brainstorming designed to
                                  help identify the root causes of a problem.
                                  Individuals propose causes to a problem that are
                                  graphically represented as branches or twigs that feed
                                  into the problem.
68. ___ Pareto Analysis

                          H.   A numerically comparative chart that rates each
                                  proposed solution with respect to solution selection
                                criteria. The sum of ratings for each solution
                                against the criteria provides a structured method for
69. ___ Brainstorming   comparison of solutions.

                          I.   A method of reaching consensus that is refinement of
                                  brainstorming. It involves the individual written
                                recording of ideas followed by a group discussion that
                                ranks and prioritizes.

70. Identify the tool or technique that is not appropriate for defining a problem:

   A. Brainstorming
   B. Cause and Effect Diagrams
   C. Flow Charting
   D. Force Field Analysis

71. Identify the tool or technique that is not appropriate for gathering information:

   A. Solution Selection Matrix
   B. Check Sheets
   C. Pareto Analysis
   D. Cause and Effect Diagrams

72. Identify the tool or technique that is not appropriate for analyzing a problem:

   A. Flow Charting
   B. Nominal Group Technique (NGT)
   C. Action Planning
   D. Pareto Analysis

73. Identify the tool or technique that is not appropriate for planning to implement a solution:

   A. Brainstorming
   B. Force Field Analysis
   C. Flow Charting
   D. Check Sheets

In the next five questions, given the steps in the process, identify the tool or technique.
Key concepts for each tool or technique are highlighted.

74. The steps on the right describe which tool or technique?

A. Cause and Effect	Step 1	Identify exactly what event is to be observed
B. Check Sheets	Step 2	Decide on the time period for data
C. Nominal Group	Step 3	Design a form that is clear and easy to use. Clearly
Technique (NGT)		label columns and leave enough space to enter data.
D. Flow Charting	Step 4	Collect data consistently and honestly
	Step 5	Total results

75. The steps to the right describe which tool or technique?

A. Pareto Analysis	Step 1	Determine how to collect and classify your data.
B. Brainstorming	Step 2	Collect data for a specified period of time.
C. Check Sheets	Step 3	Summarize recorded data in a table. Arrange from
D. Cause and Effect		large to small frequencies.
Diagrams	Step 4	Set up chart. Category=Horizontal axis
		Quantity=vertical axis
	Step 5	Plot the data in descending order with highest
		value category on the far left.
	Step 6	Draw bars.
	Step 7	Plot Cum line (if used) to scale

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76. The steps to the right describe which tool or technique?

A. Plow Charting   Step 1   Appoint a recorder
B. Nominal Group   Step 2   Make a list of all items
    Technique (NGT)   Step 3   Generate as many ideas as possible
C. Force Field Analysis   Step 4   Encourage freewheeling
D. Brainstorming   Step 5   No criticism or discussion allowed
                   Step 6   All members have an equal opportunity
                   Step 7   Rapid movement around the group
                   Step 8   Let ideas incubate

77. The steps to the right describe which tool or technique?

A. Cause and Effect   Step 1   Select an undesturbable meeting place
    Diagram   Step 2   Prepare question and post on flip chart
B. Nominal Group   Step 3   Participants sequentially share ideas, one at a time,
    Technique (NGT)   with no discussion.
C. Brainstorming   Step 4   Record all ideas openly and visibly exactly as
D. Force Field Analysis   suggested
                   Step 5   Continue process until no more ideas are generated
                   Step 6   Conduct a brief discussion only to clarify each idea
                   Step 7   Participants silently choose their top 5 - 8 ideas
                                   and rank order them
                   Step 8   Record the choices on 3X5 cards or post-its
                   Step 9   Repeat until the top 5 items are agreed to by all
                                   participants

78. The steps to the right describe which tool or technique?

A. Force Field Analysis   Step 1   Identify problem and/or solution
B. Cause and Effect   Step 2   Identify the driving factors which result if the
    Diagrams   change is activated
C. Check Sheets   Step 3   Identify the restraining factors that tend to keep
D. Solution Selection   the change from occurring
    Matrix   Step 4   Estimate strength of each
                   Step 5   Identify each as Type I, Type II, or Type III issue
                   Step 6   Develop Strategy to implement the change
                                   Maximize driving forces
                                   Minimize restraining forces
                   Step 7   Change restrainer to a driver
                   Step 8   Summarize results

79. This diagram is associated with which of the following tool or technique?

A. Cause and Effect Diagrams
B. Pareto Analysis
C. Action Planning
D. Check Sheets

80. This diagram is associated with which of the following tool or technique?

A. Solution Selection Matrix
B. Check Sheets
C. Pareto Analysis
D. Nominal Group Technique
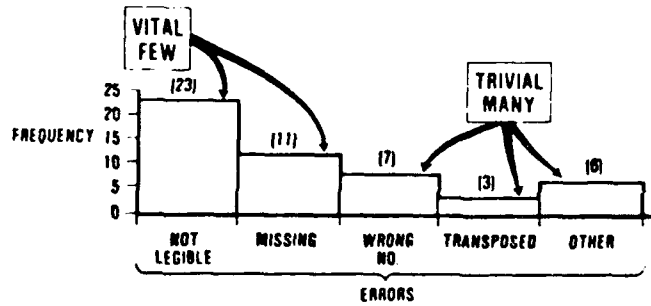
81. This diagram is associated with which of the following tool or technique?

A. Force Field Analysis
B. Cause and Effect Diagrams
C. Action Planning
D. Flow Charting
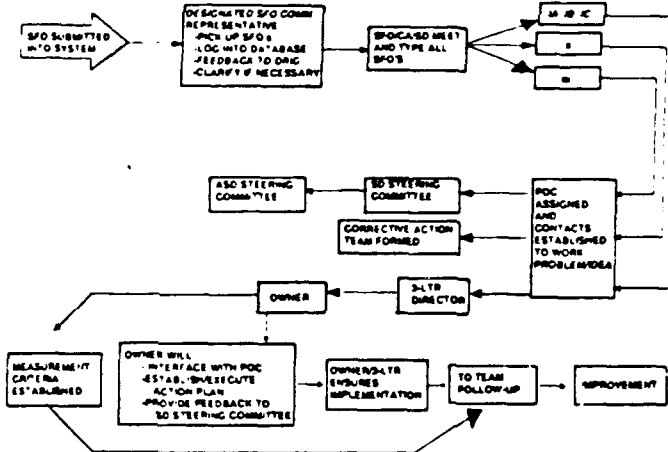
82. This diagram is associated with which of the following tool or technique?

A. Solution Selection Matrix
B. Check Sheets
C. Nominal Group Technique
D. Brainstorming

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83. This diagram is associated with which of the following tool or technique?

A. Force Field Analysis
B. Cause and Effect Diagrams
C. Check Sheets
D. Solution Selection Matrix

STATUS QUO LINE

DRIVERS   RESTRAINERS
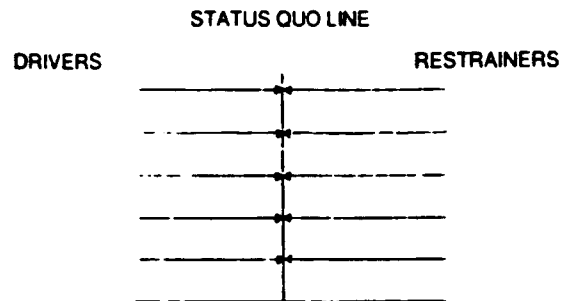
84. This diagram is associated with which of the following tool or technique?

A. Flow Charting
B. Cause and Effect Diagrams
C. Force Field Analysis
D. Action Planning

MACHINERY   MANPOWER

MAINTENANCE   TRAINING
          AGE

COST   FOLLOWED

   QUALITY   WRITTEN

MATERIALS   METHOD
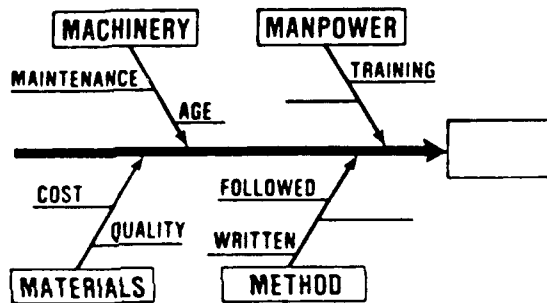
Appendix E: CAT Leader Graduate Questionnaire

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AERONAUTICAL SYSTEMS DIVISION (AFSC)
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433-6503

REPLY TO
ATTN OF: TQ   30 April 1991

SUBJECT: Corrective Action Team (CAT) Leader Training Effectiveness
          Research

TO ASD CAT Leader Training Participant

1. This package is part of a coordinated research effort
designed to evaluate and identify metrics for Corrective Action
Team (CAT) leader training. Please take a few minutes to
complete the attached questionnaire and return it in the enclosed
envelope by 14 June 1991. The questionnaire was specifically
designed to take less than 20 minutes to complete.

2. As individuals who have received the training and had the
opportunity to apply what was presented, you provide a unique
source of information that can guide future course improvements
to make CAT leader training more effective in the ASD
organization.

3. Your responses will be combined with those from other
respondents and will not be attributed to you personally. Any
information you can provide through feedback and suggestions will
be useful. Copies of the final results for the entire evaluation
will be available in September at ASD/TQ. If you have any
questions, please contact Capt Kirk Streitmater, AFIT/LSG, 255-
4437 or Mr Dale Wissman, ASD/TQ, 255-1755. Thank you for your
consideration.

Ronald A. Fullerton, Colonel, USAF   4   Atch
Commander's Assistant   1.   Questionnaire
  for Total Quality   2.   AFIT Form 11C
                                          3.   Definitions
                                          4.   Return Envelope

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Privacy Act

In accordance with paragraph 30, AFR 12-35, the following information is provided as required by the privacy act of 1974:

   a. Authority:

         (1) 5 U.S.C. 301, Departmental Regulations; and

         (2) 10 U.S.C. 8012, Secretary of the Air Force, Powers, Duties, Delegation by Compensation; and

         (3) DOD Instruction 1100.13, 17 Apr 68, Surveys of Department of Defense Personnel; and

         (4) AFR 30-23, 22 Sep 76, Air Force Personnel Program.

   b. Principle purposes. The research is being conducted to collect information to be used in evaluating the corrective action team (CAT) leader training conducted at Aeronautical System Division and improve the Total Quality (TQ) program effectiveness in that organization.

   c. Routine uses. The data will be converted to information for use in research of management related issues dealing with TQ. Results of the research, based on data provided, will be included in published articles, reports, or texts. Distribution of the results of the research, based on the data collected, whether in written form or presented orally, will be unlimited.

   d. Participation in this research is entirely voluntary.

   e. No adverse action of any kind may be taken against any individual who elects not to participate.

Instructions

1. Review each item and answer appropriately.

      -You may mark on the package.
      -Refer to definitions in Attachment 3 (if necessary).

2. Transfer your responses onto the AFIT Form 11C.

      -Do not identify yourself in the response sheet.
      -Use a number 2 lead pencil to respond.

3. Place the response sheet in the envelope provided.

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Section 1: Personal/organizational

This section will provide general background information regarding
characteristics respondents who have taken CAT leader training.

1. If military, what is your current rank? (leave blank if civilian)
    1. Enlisted (E-1 to E-5)   4. Captain
    2. Enlisted (E-6 to E-9)   5. Major
    3. Lieutenant   6. Lt Ccl/Colonel

2. If civilian, what is your current grade? (leave blank if military)
    1. GS-3 thru GS-5   5. GS-13 thru GM-14
    2. GS-6 thru GS-8   6. GM-15
    3. GS-9 thru GS-10   7. Other
    4. GS-11 thru GS-12

3. What was your age at your last birthday?
    1. Under 21   5. 36-40   9. 56 or older
    2. 21-25   6. 41-45
    3. 26-30   7. 46-50
    4. 31-35   8. 51-55

4. What is your sex?
    1. Female   2. Male

5. What is your highest achieved education level?
    1. High school Diploma   4. Master's Degree
    2. Associate's Degree   5. Doctoral Degree
    3. Bachelor's Degree

Section 2: Training Information

This section will provide information that will allow time trend analysis
for CAT leader training applications.

6. Are you currently in the organization that sponsored you for CAT
    leader training?
    1. Yes   2. No

7. Select training date (Note: training date is on your mailing label)
    1.   1 Sep 89   4. 17 Nov 89   7.   9 Feb 90
    2. 29 Sep 89   5.   8 Dec 89   8. Other - item 8 or 9
    3. 13 Oct 89   6. 12 Jan 90

8. Select training date (Note: training date is on your mailing label)
    1.   9 Mar 90   4.   8 Jun 90   7. 10 Aug 90
    2.   6 Apr 90   5. 13 Jul 90   8. Other - item 7 or 9
    3.   4 May 90   6. 20 Jul 90

9. Select training date (Note: training date is on your mailing label)
    1. 14 Sep 90   4.   7 Dec 90   7. 12 Apr 90
    2. 12 Oct 90   5.   8 Feb 90   8. Other - item 7 or 8
    3. 16 Nov 90   6. 22 Mar 90

Section 3: Assignments and status of CATs

This section will provide information on CAT involvement and status.

10. How many CATs have you been involved with (as a leader or participant)?
     1. 0 (SKIP to item 21)
     2. 1
     3. 2
     4. 3 or more

11. Which of the following best describes the status of your most recent CAT?
     1. CAT currently open.
     2. Recommendations made and implemented and CAT disbanded.
     3. Recommendations made but not yet implemented and CAT disbanded.
     4. CAT approach found inappropriate and other approaches pursued and CAT disbanded.
     5. Unknown - I am no longer in that organization.

12. Regarding your most recent CAT affiliation, how would you rate the applicability of using a CAT problem-solving approach in addressing that specific issue?
     1. The CAT problem-solving approach is/was very applicable.
     2. The CAT problem-solving approach is/was somewhat applicable.
     3. The CAT problem-solving approach is/was not very applicable.
     4. The CAT problem-solving approach is/was not applicable.

13. Have you served/are you serving as a CAT leader since receiving training?
     1. Yes
     2. No - Not yet assigned an issue, but planned (SKIP to item 15).
     3. No - No plans to function as a CAT leader (SKIP to item 15).

14. What was the time gap between training and assignment as a CAT leader?
     1. Was assigned CAT issue prior to training
     2. 0 - 1 month
     3. 2 - 3 months
     4. 4 - 6 months
     5. 7 months - 1 year
     6. Over 1 year

15. Are you currently involved in a CAT?
     (Give highest level of involvement applicable)
     1. No (SKIP to item 21)
     2. Yes, I am leading a CAT.
     3. Yes, I am an assistant leader.
     4. Yes, I am a participant, but not a leader.

16. Is the CAT identified in item 15 the first that you have been involved with since training?
     1. Yes   2. No

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17. How long has it been since the CAT was formed?
    1. 0 - 1 month
    2. 2 - 3 months
    3. 4 - 6 months
    4. 7 months - 1 year
    5. Over 1 year

18. Generally, how frequently does the CAT meet?
    1. One or more times per week.
    2. At least every other week.
    3. At least once a month.
    4. As the need arises.

19. How long has it been since the last meeting?
    1. Less than a week.
    2. Less the two weeks.
    3. Less than a month.
    4. more than a month.

20. How often is the CAT status briefed to the organizational leader?
    1. At least every week.
    2. At least every other week.
    3. At least once a month.
    4. A period longer than a month, but regularly scheduled
    5. As the need arises.

Section 4: Perceived abilities

This section will provide information of perceived abilities to perform different tasks.

Use the following rating scale for the next 5 statements to express your own feelings on your ability to perform various tasks.

    1. Means you strongly disagree with the statement
    2. Means you moderately disagree with the statement
    3. Means you slightly disagree with the statement
    4. Means you neither disagree or agree with the statement
    5. Means you slightly agree with the statement
    6. Means you moderately agree with the statement
    7. Means you strongly agree with the statement

21. I feel I have the capability to lead a group of individuals through the problem-solving process to resolve an organizational issue.

22. I feel I have the capability to explain the TQ structure and philosophy to individuals in my organization.

23. I feel comfortable using the tools and techniques of problem-solving in a group environment to address an organizational issue.

24. I feel I have the capability to prepare and lead an effective meeting.

25. I feel I understand the subject of group dynamics enough to build an effective team to solve an organizational issue.

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Section 5: Use of Tools and Techniques

This section will provide information on the level and frequency of use of problem-solving tools and techriques.

Please identify the highest level of use for each of the following items.
(1=lowest, 5=highest) in settings other than training courses.
Note: Definitions for each item are provided in Attachment 3.

Level of Use

1. Have not used personally and have not seen used.
2. Have not used personally but have seen used in a CAT setting.
3. Have not used personally but have seen used in an organization setting
4. Have personally used in a CAT setting.
5. Have personally used in an organization setting.

26.	Steps in problem-solving.	(1)	(2)	(3)	(4)	(5)
27.	Brainstorming.	(1)	(2)	(3)	(4)	(5)
28.	Nominal Group Technique (NGT).	(1)	(2)	(3)	(4)	(5)
29.	Cause and Effect Analysis (Fishbone Diagrams).	(1)	(2)	(3)	(4)	(5)
30.	Pareto Analysis.	(1)	(2)	(3)	(4)	(5)
31.	Check Sheets.	(1)	(2)	(3)	(4)	(5)
32.	Flow Charting.	(1)	(2)	(3)	(4)	(5)
33.	Solution Selection Matrix.	(1)	(2)	(3)	(4)	(5)
34.	Force Field Analysis.	(1)	(2)	(3)	(4)	(5)
35.	Action Planning.	(1)	(2)	(3)	(4)	(5)

Please identify the number of times you have seen this tool or technique used in the past three years outside of training courses (i.e. in the work environment).

Frequency of Use

1. Never
2. Once
3. Twice
4. Three or more times

36.	Steps in problem-solving.	(1)	(2)	(3)	(4)
37.	Brainstorming.	(1)	(2)	(3)	(4)
38.	Nominal Group Technique (NGT).	(1)	(2)	(3)	(4)
39.	Cause and Effect Analysis (Fishbone Diagrams).	(1)	(2)	(3)	(4)
40.	Pareto Analysis.	(1)	(2)	(3)	(4)
41.	Check Sheets.	(1)	(2)	(3)	(4)
42.	Flow Charting.	(1)	(2)	(3)	(4)
43.	Solution Selection Matrix.	(1)	(2)	(3)	(4)
44.	Force Field Analysis.	(1)	(2)	(3)	(4)
45.	Action Planning.	(1)	(2)	(3)	(4)

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Please identify how you would rate each of the items usefulness as a tool for team problem-solving. (Note: Definitions are in Attachment 3)

1. Very Useful
2. Somewhat Useful
3. Undecided
4. Rarely Useful
5. Not Useful

46.	Steps in problem-solving.	(1)	(2)	(3)	(4)	(5)	
47.	Brainstorming.	(1)	(2)	(3)	(4)	(5)	
48.	Nominal Group Technique (NGT).	(1)	(2)	(3)	(4)	(5)	
49.	Cause and Effect Analysis (Fishbone Diagrams).	(1)	(2)	(3)	(4)	(5)	
50.	Pareto Analysis.	(1)	(2)	(3)	(4)	(5)	
51.	Check Sheets.	(1)	(2)	(3)	(4)	(5)	
52.	Flow Charting.	(1)	(2)	(3)	(4)	(5)	
53.	Solution Selection Matrix.	(1)	(2)	(3)	(4)	(5)	
54.	Force Field Analysis.	(1)	(2)	(3)	(4)	(5)	
55.	Action Planning.	(1)	(2)	(3)	(4)	(5)	

Section 6: General Comments

This section will solicit any specific feedback regarding areas not covered or insufficiently covered by previous items.

56. After having taken the CAT Leader training course and then returned to the organizational environment, what comments or recommendations do you have for course changes and improvements? Explain below

Comments on:

TQ Background Section

Personal Values Section

Group Dynamics Section

Steps of Problem Solving Section

Tools and Techniques Section

Exercises

Movies

Final Exercise

Other

THANK YOU FOR YOUR TIME

Appendix F: CAT Leader Training Applicable Definitions

Steps in Problem Solving - A logical, systematic process aimed at understanding a problem issue and making an informed data based decision to solve the problem or optimize the opportunity. It includes six steps that are: defining the problem, analyzing the problem, evaluating solutions, planning the implementation, and implementing the solution.

Brainstorming - Verbal generation of ideas in a group that key the identification of specific details of a topic through encouraging spontaneous, rapid and creative input. Judgement is deferred.

Nominal Group Technique (NGT) - A method of reaching consensus that is a refinement of brainstorming. It involves the individual written recording of ideas followed by a group discussion that ranks and prioritizes.

Cause and Effect Analysis - A graphical refinement of brainstorming designed to help identify the root causes of a problem. Individuals propose causes to a problem that are graphically represented as branches of twigs that feed into the problem. Also known as fishbone diagrams.

Pareto Analysis - A prioritization tool involving a graphical technique where data is arranged in descending order to rank the contributors to a problem by their order of importance.

Checksheets - A method of accumulating and documenting data to assist in the detection of patterns or frequency of occurrence of events.

Flow Charting - A pictorial representation of all the major sequential steps in a process.

Solution Selection Matrix - A numerically comparative chart that rates each proposed solution with respect to solution selection criteria. The sum of rating for each solution against the criteria provides a structured method for comparison of solutions.

Force Field Analysis - A graphical techniques that identifies the driving and restraining forces that contribute to the current status of a problem. A vertical line represents the current situation and drivers and restrainers are opposed to each other on opposite sides of the line to represent the reason for the current status.

Action Planning - A written plan of action for accomplishing a stated goal. It involves specific objectives, required major activities, personnel assignments and responsibilities, and an established schedule for accomplishment.

Appendix G: CAT Leader Graduate Questionnaire Comments

Subject: Overall Comments

1. The training program provided for CAT Leaders is, by
    textbook example, very good. However, for resolving
    most of the types of problems that many individuals at
    the organizational level are asked to work, the CAT
    Training Program is overkill.

    Recommend that ASD/TQ conduct a survey in ASD,
    requesting Program Offices to identify the most common
    types of problems encountered. That is, if it has not
    yet been accomplished. Then restructure training for
    individuals based on commonality of problems to
    resolve.

    The current program is excellent for those personnel
    that are directly involved in the re-organization/
    coordination of the AFLC and ASD organization. Those
    Structures/tasks/problems are very complex.

2. Everything okay.

3. This (as I said in my evaluation of the course) was the
    best course on this subject (problem solving
    techniques) that I have ever encountered. I believe
    (some how) we should equip <u>all</u> our personnel with these
    tools.

4. I have my first CAT involvement within the next week.
    Looking forward to it. It was hard to get selected--no
    one wants to allow secretaries activities away from
    their office. Not even those working for their
    Master's degree.

5. I have not been fully utilized as a CAT Team Leader,
    therefore the training is becoming fuzzy. I feel the
    money spent training me has been wasted thus far.

6. Future courses may want to include decision making
    processes where consensus is not a requirement or
    reaching a consensus is difficult.

7. Taking the course material and making it work in your
    groups requires education of the group. Any education
    materials (plan) you could provide for the new CAT
    leader would be helpful. Copying the CAT manual is not
    appropriate, but I have made selected copies of
    material in this manual.

8. Excellent training... the problem is applying in the organizational environment! Still too many layers of management decision...

9. I feel that the participants of the CAT leader course should be from the same organization rather than several different ones. That way people get to know one another from the same unit and work on a final exercise that pertains or is related to their organization.

10. I feel the course is good and adequate.

11. Don't have any specific comments--other than I have enjoyed the course very much--thought it was very useful.

12. Need more guidance on how to deal with managements' resistance when teams try to make things happen. i.e. Education showing movies monthly on TQ working in organizations outside the government.

13. There was no follow up! Need references and other sources! I am interested in the outcome of this research.

14. TQ seems to be falling from popularity already. It may only be in the organization that I'm in.

15. The initial CAT leader training or a refresher course should be taken immediately prior to the leading of a CAT Team.

    Future CAT leaders should first be participant's or first hand observers in on going CAT teams prior to being on the firing line as a CAT leader.

    More former CAT team leaders should be used to teach parts of the leader training course.

    This survey should be done incrementally: 1) shortly after the course; 2) after CAT team participation; 3) after CAT team leader experience.

16. Our office has practices brainstorming as well as NGT on our off-site meetings but nowhere else. The mind set is such that these valuable techniques be only applied to TQ related activities, not training others to use them in day-to-day activities. Promote these techniques via training all the unwashed masses.

17. I think you are pretty much on target with everything.

18. Overall a good course.

19. Need more specific direction in conducting a CAT and dealing with problems encountered during a CAT. Also, how it interfaces with management.

20. The training, instructor, class materials and environment are all exceptional.

   The biggest obstacle to overcome is not the actual training, which is actually the second challenge, but the attitudes and "thinking" of our current work force. Most individuals attending the training are people from the "old" school of thinking. By this I mean...gone is the day when a person can achieve a job or task "alone". No more can a person exist in a world of their own, in a little office doing one specialized mission. Each individual must be diversified and have a clear understanding of many processes that effect their mission.

   Achievement of this can only be accomplished by working "together". Thus, you have the birth of not only TQ, but a whole new way of thinking. When people are convinced that without working together we will not only "not survive", but also will not be able to achieve "a Total Quality" environment, only then will they accept and "use" these wonderful tools that ASD has endeavored to equip us with to achieve this goal.

   As I have told many people, [organization]'s chief was "TQ" before it became a household word in ASD. But, he perceived his mission was to "convince" his people there was no other way to achieve our mission without working together, which in turn inspired us to strive for excellence through teamwork! We have a group of people with good "attitudes" and a new way of thinking. They are progressive thinkers, and are not afraid to try new methods. Many of our people attended your CAT training. They came back truly inspired. I felt part of it because they saw that our way of thinking wan now becoming the norm. ASD was now on the road to providing the tools for all people to have this "new thinking."

   Once people accept the idea as a "way of life", they will use the wonderful "tools" that ASD is providing.

21. Some sort of follow-up training should be accomplished. I have volunteered myself as a CAT leader member and never had the opportunity of using any of the skills I have learned at the CAT course.

22. I haven't been involved in a CAT yet, so much of my answers were either undecided or could have been answered better if I was more involved. Seems like the same people do the CATs all the time.

23. Need something on difficult people. Management needs to be educated--implementation of recommendations is their department not the CAT teams. "Don't kill the messenger because you don't like the findings."

24. [organization] middle management not sold/not using. Upper level?

25. It made me a believer in using intervals! Way to go!

26. All sections very good. They reinforced my belief that the biggest roadblock to getting the job done is interpersonal relations, not technical inadequacies.

27. CAT leader training has proven to be the most useful training I have had at ASD. Strongly recommend this training for everyone.

28. I thought the course and lessons were fine but haven't had the opportunity to employ them. I believe TQ at ASD has taken a serious setback in the last 8-9 months.

29. Have not been selected to support CAT effort and would require a review on all areas before I could be a significant team member. I endorse the CAT initiative but feel that many people are afraid to make a decision. Also maybe the teams are too large to be effective

30. 1) [more info on] how to recruit CAT team members; 2) a little more emphasis should be made regarding "how to wrap-up a CAT" besides recommendations and presentations; 3) [more info on] how to get support from 2-letter.

31. Enjoyed it!

32. All sections excellent. TQ problem solving not big in [org]. TQ education is good in [org].

33. How about a "fun" test or exam so we can be challenged to be kept current. Could be on AMS and you could monitor trends by answers received. Sponsor a Wright-Patt wide CAT leader alumni association and have someone record lessons learned and shared.

34. CAT leader training should be 3 days and not four days long.

35. It took me 40 minutes to complete this survey with one 2-minute interruption.

36. Give a framework for starting teams. Trainers just presented tools, taught how to use them and said go "build a house." When we asked "where do we start?" they said, "nothing is right or wrong just do what feels right." Suggestions of minimum start-up tasks would be good.

37. I see no reason to change anything!

38. Overall, I believe the CAT leader training was very useful training for ASD personnel. The lessons on problem solving techniques were very useful.

   Widely providing training on methods for fixing processes suggests there might be a correspondingly wide opportunities for fixing processes...

   Many processes we use are dictated externally through regulation, law, etc. I know of no significant processes or problems which have been changed as a result of CAT leader training or TQ...

   [I tried group consensus on my project team with poor results]... Team consensus works if the team is only composed of reasonable people, with like viewpoints, who are willing to compromise. That would be a rare and probably unimaginative team. I have concluded that team leaders need to try to reach consensus, but must be allowed and willing to make decisions after careful consideration of team viewpoints. Undoing consensus approach, once started is difficult. I recommend CAT leader training be very careful about encouraging consensus building as a sole method of problem solving to the exclusion of decision making.

39. Overall, it was an excellent training opportunity.

40. Good coverage (both time and material) of all sections.

41. Necessary to take the time to use skills learned, its common to have the desire to use techniques but difficult to rearrange busy schedules to implement.

42. Need to send this survey out sooner, say less than two weeks after completion. My memory is somewhat vague on making recommendations for improvements to TQ class.

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43. Keep enthusiastic teachers for the course. "Enthusiasm is contagious."

44. I found the overall training valuable outside the context of a specific CAT situation. (even useful in my community volunteer work!) Thanks.

45. Overall Super job

46. Generally useful

47. Class too long (4 days) Bring more real (ASD) issues into discussion.

48. My biggest problem is I was a CAT leader before training and now I haven't been given a CAT recently. The training needs to be given right before the team is commissioned.

49. Can this course be distilled/shortened at all? I experienced a tough time getting four days off for training from my boss, TQ or not.

50. I have used many of the things I learned in CAT training in my work and in my personal life. I recommend it for everyone whether they are TQ related or not.

51. Not every SFO or problem requires the long, tedious CAT process to apply an effective solution. In most cases -- a single action officer can solve and implement a very effective fix to a process problem. The democracy fails at times. Socialism is often abused by individuals seeking power and attention. The CAT process takes an inordinate amount of time-- much too tedious and long.

52. I thought the CAT leader training was excellent and should be made mandatory for all EN branch chiefs. Everything we do at ASD involves working with teams of people. Therefore, the CAT leader training should be given throughout ASD/EN.

Subject: TQ Background Section

1. Course I went to - discussion centered on Japanese quality initiatives and on. Feedback I received from others who had same training, but different instructors was that too much time was spent covering the fundamentals AGAIN!

2. Should be shorter--an overview.

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3. Old hat for many, but must be reviewed for folks new to
    TQ.

4. Too lengthy.

5. Tailor to the group.

6. Explain more about the Cumberland Group, where they
    started and how we got 'em.

7. Most important for SPO wide CAT training.

8. Improve presentation, book was not organized logically
    when I took the course.

9. Should be separate from CAT leader training.

10. Give us some examples of some successful CATs and CATs
    in progress for motivation.

11. Terrible, need to get with TQ office and get up to
    date.

12. People with similar levels of TQ exposure should be
    grouped together for classes and this topic structured
    accordingly.

13. Better definition of the process. who are the points
    of contact.

14. Should have more (all employees need a 40 hour course
    explaining the TQ process).

15. Too narrow a view. The cumberland Group approach is a
    misapplication of factory TQM to white collar TQM
    organizations. A broader overview with specific
    references to Deming, Crosby, etc. would be more
    valuable.

16. Do not assume everyone is completely familiar with TQ.

17. More on basics of TQ. I was sent to CAT training with
    zero info on what TQ was functionally.

18. Needed to go into more depth and not assume people were
    all knowledgeable on TQ.

Subject: Personal Values

1. Excellent. A root cause of many team problems and
    disagreements. Not fully appreciated or used by most
    trainees. The personality tests red-green-blue was not

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very helpful-- Myers-Briggs would be better, more usable, and widely recognized.

2. Interesting. Good.

3. Good input.

4. Informative.

5. Showing how values related to lifetime goals was important. Then, I was better able to understand the goals setting process in the work place.

6. Excellent-- sets the stage.

7. Good section to help people better understand how the way people are raised affects how they will work together on a team.

8. Inappropriate and unprofessional examples used to make a point. Why "not have sex with others"

9. Important to learn about oneself.

10. Very valuable

11. No preaching

12. Terrific-- opened my eyes.

Subject: Group Dynamics

1. Needed more time.

2. OK, but could be much improved by reviewing current research and books on high performance teams. The focus on the stages the teams go thru is not enough.

3. How about role playing to deal with difficult team members?

4. This was especially interesting to me, because it clarified to me how I come across to others (clarifying/dominating).

5. Sometimes kind of technical.

6. Vital.

7. Terrific-- opened my eyes.

Subject: Steps of Problem Solving

1. Needed more time.

2. Condensed handout for group distribution.

3. Some seem more useful than others.

4. Extremely important. Able to use if able to remember
    this process. Suggest a summary card be printed and
    handed out to students. Could post card on desk.

5. Vital.

6. Now I know how to approach problem solving in an
    orderly and logical way.

Subject: Tools and Techniques

1. Good coverage.

2. Condensed handout for group distribution and education
    of team.

3. OK. Need more examples and explanation of when to use.
    Why should you choose one method over another.

4. The fishbone diagrams, pareto analysis, solution
    selection matrix, and force field analysis are nice
    concepts but do not work like the human mind so they
    seem like more work than they are worth. Nobody ever
    uses them.

5. More background info would be useful. I knew what was
    going on because of previous training, but others were
    lost.

6. Need to weed out least used ones and spend more time on
    others.

7. Skinny down, clean up manual.

8. Could have been explained better. In some cases, over-
    simplification complicated explanation.

9. If you try to use any of these techniques in a non-TQ
    meeting, people think you are trying to "force TQ" upon
    them. Suggest application methods in meeting
    situations.

10. One of the most helpful.

11. Emphasize this more. As new techniques are learned, make sure all CAT leaders are educated.

12. Don't overload people all at once.

13. Need better examples or explanations-- especially Pareto Analysis.

14. Vital (could use a summary card for quick reference at the job site.

15. Copier problem overworked.

16. So-so.

Subject: Exercises

1. Not all related to our environment.

2. OK, but rushed. Instructor with our group didn't seem interested and wasn't helpful.

3. Very effective and enjoyable. Kept my attention.

4. Would rather work on [examples] more relevant to the work place.

5. Desert Storm exercise was <u>inappropriate</u> example for synergy. Scoring system was flawed.

6. Good for working through the process without a lot of stress.

7. Very effective.

8. Some good, some very flimsy data to begin with.

9. This above all, probably gives greatest applicability back to the work environment. However the exercises need to be related to work (applicable) and substantial (not fluff).

Subject: Movies

1. Good examples.

2. There is a definite lack of QUALITY TQ movies available for general use. The movies in the CAT course weren't too bad.

3. A waste of time.

4. Paradigm film was outstanding.

5. All movies should be shown in one type of training course or another-- too much duplication.

6. Don't remember seeing any movies. Would be a good tool (ex: CAT team in action solving a problem).

7. *Meeting Robbers* is great.

8. *The Abilene Paradox*-- great.

Subject: Final Exercise

1. Good approach.

2. This exercise was great in that it tied all the information into practice. A true synergy example.

3. Our group presentation was a disaster because of one individual. I don't know what you can do to correct those types of problems.

4. Took my group all day and still had problems. In the final problem, the number of customers at the base cafeteria was declining. I had difficulty grasping why this was a problem. If one base cafeteria is no longer needed, then that's a savings to the U.S. taxpayers. Others in the group didn't seem to have any difficulty in seeing the problem, perhaps because we were required to have a solution in a few hours. Something needs to be done to get a clear concept of the mission. At one point in the class, visiting CAT team leaders were asked to give their experiences as a CAT leader using TQM. One individual was quite proud of her accomplishment of pushing routine paperwork away from a secretary making $10/hr onto a manager making $50/hr. As it turned out, the occurrence of declining customers at the cafeteria was due to a safety problem. Up front, the goal of the group should have been to discover in any health or safety dangers existed at the cafeteria and not to increase clientele.

5. Need a more relevant problem than bad coffee.

6. Overhearing other groups' progress ruins the effectiveness of the exercise.

7. Excellent! Could apply everything that was taught-- brought everything together.

8. Would rather work one more relevant to work place.

9. This exercise was good. However, I would schedule it
    <u>around</u> lunch. The final day should include a time when
    cohesiveness of class members should materialize
    without stress. A working lunch is very stressful to
    me. People need a break during the day to renew
    themselves so that they can operate at peak performance
    (TQ) during the afternoon as well as during the
    morning.

10. Interesting.

11. Well done and vital to get the hand-on experience that
    fixes the concepts in your mind.

12. Needs work.

13. Certainly brings group dynamics into use.

14. This above all, probably gives greatest applicability
    back to the work environment. However the exercises
    need to be related to work (applicable) and substantial
    (not fluff).

15. Had to wait on other groups to see the leader
    (facilitator) which impacted time spent on exercise.

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Vita

Captain Kirk J. Streitmater was born on 3 April 1964 in Lowell, Massachusetts. He graduated from Londonderry High School in Londonderry, New Hampshire in 1982 and attended the U.S. Air Force Academy, graduating with a Bachelor of Science degree in Astronautical Engineering (specialty: guidance and control theory) in May 1986. He began his acquisition career upon assignment to Wright-Patterson AFB in January 1987 as a configuration control manager for the B-1B weapon system that was currently in production. During the next two years, his responsibilities included coordinating the waiver and deviation process for the entire program and serving as the senior configuration manager for the B-1B offensive avionics technical baseline. In November of 1989, he was assigned as a B-1B Special Projects Manager and oversaw a fleet retrofit of the offensive avionics system and a safety related high priority electrical multiplexing system project. In addition to his other duties, in the summer of 1989, he was selected as the first chairman of the B-1B Total Quality Team charged with implementing a quality program in the organization. He served in this regard until entering the School of Systems and Logistics, Air Force Institute of Technology, in May 1990.

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REPORT DOCUMENTATION PAGE

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13. ABSTRACT (Maximum 200 words)

This study evaluated corrective action team (CAT) leader training, a team dynamics and group problem solving course provided by an Air Force product division. A knowledge test was administered to 61 participants as part of an internal evaluation while 373 past participants were provided a questionnaire for a field evaluation. Results from the internal evaluation indicated that students learned the majority of training material presented in the course. Self efficacy increased in most cases showing an improved self-perception regarding the ability to perform training related tasks. Predictors for a pre-test score model were identified, but overall provided limited explanatory power to predict a student's pre-score result. The field evaluation showed that the majority of graduates, 152 out of 208 (73%), do not function as CAT leaders. Those who do lead CATs, are assigned an issue within three months of training and consider the issues worked relevant to a group problem solving approach. Half of the ten tools and techniques taught in training were used by the majority of graduates, while the other half saw little use. All the tools and techniques in the current curriculum are perceived as having at least some degree of usefulness by those who responded.

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